UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

November 25, 2003

EPA-SAB-CASAC-04-001

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

Honorable Michael O. Leavitt
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Subject: Clean Air Scientific Advisory Committee Review of the Agency's *National Ambient Air Monitoring Strategy*

Dear Administrator Leavitt:

The Clean Air Scientific Advisory Committee's (CASAC) National Ambient Air Monitoring Strategy (NAAMS or "Strategy") Subcommittee ("Subcommittee") met on July 8-9, 2003 to review the Agency's) National Ambient Air Monitoring Strategy document in a public meeting held at the EPA facility in Research Triangle Park, NC. This was the first CASAC-related review of the draft NAAMS document. Members of the newly-formed CASAC NAAMS Subcommittee are recognized, national-level experts in one or more of the following disciplines: (a) atmospheric sciences and air quality simulation modeling; (b) health effects and exposure; (c) air quality measurement science; or (d) State or local agency experience.

1. Background

EPA had developed the final draft of the NAAMS document under the direction of the National Monitoring Strategy Committee (NMSC), an intergovernmental partnership comprising representatives from EPA (*i.e.*, the Office of Air Quality Planning and Standards (OAQPS), the Office of Research and Development (ORD) and Regional Offices), and State and local agencies and Tribes (who are the principal Federal grantee organizations that operate the majority of the monitoring networks). The draft NAAMS document contains technical information underlying planned revisions of the National Ambient Air Monitoring program. The Strategy proposes a restructuring of the national regulatory-based air monitoring networks — commonly referred to as National Air Monitoring Stations (NAMS), State or Local Air Monitoring Stations (SLAMS), and Photochemical Assessment Monitoring Stations (PAMS) — to accommodate emerging priorities of air programs, the public and the scientific community. Specifically, the NAAMS provides a series of proposed changes for network design and improvements, assessments of existing networks, incorporation of new measurement and information transfer technologies, and revisions both to the current quality assurance program and the monitoring regulations. The NAAMS document is available through EPA's Ambient Monitoring Technology Information Center (AMTIC) Web site at: http://www.epa.gov/ttn/amtic/stratmem.html.

The Subcommittee had been asked to provide formal review of the following elements of the Strategy:

(a) The NCore proposal, including conceptual approach to tiered monitoring levels, recommended measurements and numbers and locations of Level 2 sites. Consideration to phasing of measurements included in Level 2 sites should be addressed based on currently available and expected emerging monitoring technologies. The Subcommittee is also requested to advise on the scope and breadth of research-grade Level 1 sites.

(b) The use of spatial analysis approaches for network design and other air program planning needs. The monitoring strategy has utilized various spatial design approaches on national and regional scales to identify areas of redundant monitoring as well as gaps requiring additional monitoring.

(c) The use of performance-based approaches for standardizing monitoring method requirements for particulate matter measurements. Performance-based approaches rely on applying data quality objectives to determine the allowable statistical uncertainties for instrument performance. This third subject area has evolved from discussions with the existing CASAC Subcommittee on Particulate Monitoring, and plays an important role in facilitating accommodation of new technologies into air monitoring networks.

2. CASAC NAAMS Subcommittee Review of the Agency's *National Ambient Air Monitoring Strategy* Document

The CASAC NAAMS Subcommittee would like to strongly commend EPA's OAQPS and the State, Local, and Tribal (SLT) agencies involved in developing this draft strategy. It is an excellent idea to periodically review how things are done and why they are structured as they are. The idea of stepping back and looking at why we need air quality monitoring and then evaluating what needs to be measured and where is a key step to moving forward in air quality management as well as potentially providing critical information for obtaining a better understanding of air quality and health and welfare effects.

The strategy provides a very good conceptual framework for moving forward with assessing and modifying the monitoring network. The basic concepts of fewer, but more comprehensive measurement sites with an emphasis on more continuous measurements and a better balance between urban and rural sites are appropriate and important steps forward. Our view of the air pollution problem has evolved from that of local sources of one or a few pollutants causing local impacts to a more informed view that local sources produce an increment of input to regionally transported concentrations of a variety of materials that are chemically reactive and involve both criteria and non-criteria species. Thus, the incorporation of a more regional view of air pollution to help examine this aspect of the problem is a good step forward.

However, there are many operational details that need to be developed and implemented in order to achieve the goals outlined in the draft strategy. Thus, in addition to responding to the specific questions presented in the charge, the Subcommittee has reviewed the Strategy and provided comments on both the Strategy and a number of implementation issues that will need to be carefully considered in order to achieve the Strategy's stated goals. This report provides the consensus views of the Subcommittee. The comments of the individual members are provided in the appendix to this report.

The Strategy sets out a set of Objectives for the ambient air monitoring network. They are supposed to represent a complete set of objectives for the restructured monitoring network. The charge to the committee asks if all the potential uses of the output of air monitoring are adequately reflected in the Objectives.

One member of the NAAMS Subcommittee raised the issue of ecological/welfare effects and monitoring since monitoring in support of ecological/welfare effects is nonexistent in the Plan. This need for monitoring to provide protection for ecosystems and welfare effects warrants incorporation in the strategy. EPA acknowledged that the Plan intentionally ignored ecological and welfare effects due to the lack of a constituency within OAQPS. The Subcommittee requests that ecological/welfare effects be explicitly addressed and that a formal Plan be developed and submitted for review by the Subcommittee within 180 days. Since there are to be a substantial number of monitors redeployed to rural locations the focus is still on better understanding of the air quality for human health protection. The Subcommittee recommends that ecological/welfare issues be included as a part of the siting decisions for these monitoring locations.

There is currently monitoring being conducted to assess welfare effects that have not been coordinated with the NAAMS. For example, the National Acid Deposition Program (NADP) network is measuring the composition and fluxes of acid precipitation to provide the data needed to assess the impacts of acid deposition on ecosystems. It would be useful to initiate discussions with the NADP management so as to coordinate their measurements with components of the EPA ambient air monitoring such as CASTNET and IMPROVE in order to maximize the information content of the resulting data. The principles and procedures of incorporating non-NCore datasets such as NADP, satellite data and surface visibility data into the monitoring program should be explicitly considered by the Strategy.

In addition, these objectives are currently unstructured in terms of priority and the Subcommittee is concerned that when possible conflicts arise among the objectives, there is not a clear guidance as to which objectives should take precedence. There may be a lack of consistency in the monitoring network that might diminish the effectiveness of the redeployment and the utility of the data that will result from the restructured monitoring network. It may be useful to at least separate primary and secondary objectives rather than to produce a fixed set of ordered objectives. Without some degree of prioritization, it is hard to have an effective assessment process that will examine the existing network and restructured networks in a manner that will best meet the essential monitoring objectives.

The first step in the process will be for the SLT agencies to assess the existing monitoring networks. The Strategy provides some examples of assessment processes, but there are several problems that need to be addressed. Given the regional nature of many air pollution problems, it is critical that there be a consistent approach to monitoring and comparable monitoring network performance across logically connected air shed regions. The Subcommittee strongly suggests that OAQPS develop a guidance document for network assessment that provides a solid context for the evaluation of the existing networks and of alternative designs for a revised and refined network. These guidelines have to reconcile the need for nationally consistent assessment with the regionally specific monitoring and assessment requirements.

The assessment process will need to be comprehensive. For example, the Region 5 examples given in the Draft Strategy are for a single species and are not multiple species assessment. Since multiple pollutants (ozone, NO_x, SO_2, reactive hydrocarbon compounds including some hazardous air pollutants (PAMS, HAPs), and $PM_{2.5}$) are interconnected in terms of sources, atmospheric chemistry and spatial impacts, comprehensive, multiple species monitoring will need to be emphasized in the guidance developed and provided to the SLT agencies who will have to make the final decisions with regards to network structure and operation. However, if organic species are to be measured, then it is critical that the measurement program should be integrated into an overall air quality management strategy that will actually make use of the data being collected.

The Subcommittee was specifically asked to comment on the use of spatial analysis in network design and the utilization of the resulting data. Currently, the Strategy has very little detail on the use of spatial analysis as part of the monitoring network assessment, design, or application of the resulting data. It may not be useful to put a lot more detail on spatial analysis methods into the Strategy, but the detailed discussion of these methods will be critical as part of the network assessment guidance as well as future guidance on the interpretation of the resulting network data. The Subcommittee supports the use of a number of well-established spatial analysis tools such as kriging, empirical orthogonal function analysis and related techniques, and geographical information system (GIS) approaches that can be used for these purposes. These tools can also be used in the regulatory decision-making process, such as establishing the spatial domain of non-attainment areas for the criteria pollutants.

In addition to data analysis tools for the monitoring network, there are a variety of other data sources than can be used to assist in the spatial analyses. These include satellite images and remote sensing data that can be combined with the ground level monitoring data to provide a richer source of information that can be exploited as input to a variety of air quality decisions. At this time, there are a variety of approaches used for defining the region over which a monitor measurements apply. Again, there will be a need for clear guidance that describes the well-documented spatial tools and how they can and should be applied to the interpretation of data from the monitoring network, for network assessment and design, and, eventually, for regulatory decisions.

In addition to the data obtained through NCORE, there are a variety of other data sources that can be used to assist in the spatial analyses. These include data from several satellites, surface visibility data from weather stations and other remote sensing data. These data can be combined with the ground level monitoring data from NCORE sites, to provide a richer source of information that can be exploited as input to a variety of air quality decisions.

The Subcommittee supports the conceptual framework of the National Core Network (NCORE) approach that is described in the Strategy. The Strategy suggests a three-level approach. L1 sites are high level sites at which research level instruments are deployed. L2 are multi-component monitoring sites (L2) with sophisticated commercial instruments that provide more highly time resolved data and measure species than have been typically included in the national regulatory-based air monitoring networks, commonly referred to as National Air Monitoring Stations (NAMS) and State or Local Air Monitoring Stations (SLAMS). Finally, L3 sites will be primarily used for regulatory compliance measurements like the NAMS/SLAMS sites currently employed for real-time mapping and public communication. There are a number of issues regarding this design that the Subcommittee discussed and for which we have recommendations.

The Strategy presents this three-tiered structure as a pyramid that suggests continuous gradations in capabilities between the L3 and L2 sites and between the L2 and L1 levels. It is clear that some L3 sites will need to be equipped with more capabilities than others depending on the assessment of the measurement needs and may well approach the level of sophistication for a basic L2 site. The L2 sites can range from rather basic speciation and/or PAMS sites through ones in which commercially available semi-continuous monitors are in operation.

The Subcommittee does agree that there is a continuing need for L1 sites where the latest in monitoring technology can be tested under realistic field conditions. Long-term operation of L1 sites at a limited number of locations could also provide critical information for improved human health studies. As the Strategy states, there is currently no funding available to develop such sites. It will be very useful to EPA and the SLT agencies to ensure that there continues to be development and testing of advanced monitoring methods and thus, OAQPS should seek additional resources to permit at least a minimum number of L1 sites to be deployed. It will be valuable to establish a minimum number of permanent L1 sites to support the Strategy's objectives. Funding for these L1 sites cannot come from a decrease of other aspects (L2 and L3 sites) of the monitoring strategy. EPA should consider a more substantial level of methods development and field testing support from the Office of Research and Development (ORD), and more direct coordination between ORD and OAQPS than has been evident in recent years. Another useful effort will be to augment a number of L2 sites with additional infrastructure such as additional power and shelter space such that government, industry and university researchers could easily bring new technology to these sites for side-by-side operation against existing sophisticated commercial technology that would be in operation at the L2 sites.

Another aspect of individual L1 sites to be considered is that they should be designed and deployed to meet a relatively limited number of objectives and that different sites may be deployed to meet different objectives. For example:

1. Methods assessment (1 to 2 sites)
2. Intercontinental transport (1-2 sites)
3. Intracontinental transport (1-2 sites)
4. Health effects (1 to 3 sites)
5. Continued evaluation of performance-based assessments (1-2 sites)
6. Specific regional issues

Each site might have two, and possibly three missions. The Subcommittee suggests that limiting the number of objectives for any specific L1 sites makes it more likely that they can be successful rather that trying to meet a broad suite of needs and not being able to adapt to the potentially conflicting requirements.

The document seems to reinforce the view that if the concentrations of gaseous criteria pollutants are low compared to the standards, then measurements can be eliminated. The Subcommittee asserts that this is not the case given the broader need for these measurements. At this time, CO and SO_2 violations have generally been eliminated. The gas concentrations may no longer reach the levels of the standards, but the data provide critical information for air quality management. Clearly, good NO_x measurements in ozone problem areas are critical to design and implement optimum control strategies. CO and SO_2 measurements can still provide useful information for examining pollutant sources and estimating atmospheric processes using atmospheric chemistry models.

In general, the problem is that the compliance monitors were designed for higher concentrations than are now typically observed and thus, more sensitive and more specific monitors are needed. If these monitors are not yet available, then an appropriate development effort should be initiated to provide such monitors in as short a time as possible. There is discussion of this approach in the document, but there is often a sense that the need for gas monitoring has very substantially diminished and does not need to be considered in the future. The Subcommittee believes that better monitors are clearly needed at both selected L3 and most L2 locations. The decision should be on an individual basis based on the network assessment and the needs for understanding the air shed behavior to provide the information needed for appropriate air quality planning.

There is a lack of a well-articulated plan for "technology transfer" from Level 1 to Level 2 and Level 3 sites. The Strategy states that "the perspective that a clear demarcation exists between science-oriented and agency-based monitoring is counterproductive to optimizing the collective value of research and air monitoring" does not fully identify the nature of the problem. The demarcation has existed in the US monitoring programs because there are no consistent protocols and procedures to transfer high-grade science and technology coming from research to the routine monitoring performed by the state and local agencies. For example, SLT personnel are not usually amenable to new technologies unless instrumentation has been proven to be truly ready for widespread deployment.

There was an explicit charge to the Subcommittee to examine the L2 number and siting criteria. The Subcommittee identified a numerical error in Table 2 of the Strategy Summary document in that the site numbers do not add to the correct totals. The idea of 70 to 100 L2 sites appears to be reasonable. The siting is currently presented in broad terms in terms of distributions among the states and between rural and urban sites. However, this general distribution of sites also appears reasonable. The specific choices of location will be important and one aspect of these choices may be to find sites where it is possible to relate explicitly the location to health studies or other important research objectives. The EPA will shortly be awarding a grant for long-term epidemiological studies. It will be useful if siting decisions can be coordinated with the epidemiology grantee such that the greatest benefits can be obtained from the site deployments. At the same time, the importance of L2 measurements at rural sites should not be understated – as the benefits of such measurements in developing a better understanding of pollutant (and precursor) transport, chemistry, natural sources, visibility effects and for model development and evaluation may be substantially greater at rural "background" sites than in heavily populated urban centers (where scales of representativeness are inherently less certain). The L2 sites need to be placed at locations based on the understanding of the atmospheric processes that are being measured and not driven by political considerations that detract from the scientific utility of the resulting data.

One of the principles that needs to be incorporated in the network implementation plans is to preserve the integrity of the monitoring system over time. There needs to be an effort to development approaches to assure comparability between old and new monitoring methods. Otherwise, critical trend information will be lost. Thus, it will be typically necessary to operate old and new monitors for an appropriate interval to permit cross-calibration to be performed and maintain continuity of information.

One of the key aspects to eventual success of the new monitoring strategy will be to provide a mechanism for utilizing new monitoring technology as it evolves. The L1 sites provide the opportunity to field test new systems. At this stage, the data quality objectives for the technology could be defined and compared to new system performance. As the technology matures, commercial prototypes can be deployed at a limited number of advanced L2 sites to provide the data needed to develop the correspondence in the values between the old and new measurement technologies. The Subcommittee supports the data quality objectives process that can lead to carefully defined performance standards for new measurement systems. In the past, design standards have been used to produce a high level of measurement precision. However, they tend to inhibit the development and deployment of new technologies that might provide more complete and useful data. Previously, the CASAC PM Monitoring Subcommittee has commented that it has been overly difficult to qualify continuous $PM_{2.5}$ monitors as equivalent methods. Approaches have now been developed and incorporated into this Strategy document to permit more continuous monitors into the compliance monitoring network. However, it would be better to define performance standards. Previously there were problems with the PM_{10} Federal Reference Method (FRM) monitors because the performance standards were not defined with sufficiently rigid specification to ensure the precision needed for regulatory purposes. In the interim, the data quality objectives (DQO) approach has been defined and thus, in the future, it will be possible to match performance standards with data quality needs. Such an approach will assure the required data quality while providing much more flexibility for commercial instrument developers to produce the best technology for each monitoring need.

Another important aspect of a new national network strategy will be improved quality assurance and operator training. The routine L3 sites will be similar to existing NAMS/SLAMS sites in terms of their complexity, but it is likely that more advanced L3 and many of the L2 sites will include more complex monitoring tools. A well designed national quality assurance approach with extensive training including provision for on-going training for new SLT personnel will be needed. For example, when the $PM_{2.5}$ network was deployed, there was an extensive effort to provide training to the operating personnel. However, over time, there is turnover of operating personnel who have not had direct training. Depending on the quality of the exchange of information between personnel at the SLT level, there can be a degradation of the level of operational capability. Thus, OAQPS must develop regular training programs such as short courses and the opportunity for SLT personnel to utilize such training. This training needs to include the full range of measurements being made within the L2 and L3 levels and not just focus on the criteria pollutants. The comparability of all of the measurements is critical for appropriate regional data analyses.

There are several other aspects of the Strategy that the Subcommittee felt the need to comment on. Currently there is too much specific emphasis on increased measurement of air toxics in the Strategy. There is already an initial monitoring effort started following the guidance of the National Air Toxics Assessment and additional resources have been allocated this year to support HAPs monitoring. It is not clear to the Subcommittee that there needs to be a substantial additional emphasis on HAPs outside of the a comprehensive monitoring strategy that considers the variety of roles that HAPs species may play in the atmosphere such as being ozone precursors. HAPs need to be included in the comprehensive planning of the redeployed national network, but they do not required the added emphasis that the Strategy currently places on them.

The current data delivery system for the general public, AirNow, was judged to be highly effective and with the incorporation of additional continuous particle monitors in the network, there will be even more effective web access to the data. However, there is inadequate access to the actual near real-time data. The Air Quality System does not provide adequate access to near real-time air quality monitoring data. These data could be useful to a variety of groups including researchers and public interest groups. The IMPROVE network provides a model system for making their data accessible to any potential users. EPA along with the SLT agencies are expending considerable resources to obtain the air quality monitoring data and these data have not been fully utilized because they are so difficult to obtain. The Subcommittee very strongly recommends that a much better web-based system be established so that all of the data are made available quickly. Making data available rapidly raises the issue of data review and validation. Again there are other models within US agencies in which preliminary data is made available immediately with associated appropriate caveats and then validated data are subsequently provided. Other agencies provide raw data with clear information about the potential for data quality issues and then subsequently provide one or two additional levels of data after various levels of data validation and review. The Strategy should provide convenient mechanisms of of user-feedback, particularly pertaining to data quality.

Certain aspects of "routine data analysis" could also lend themselves to automation. For example: calculations of daily, weekly, monthly, seasonal and annual means, percentiles, exceedance counts, cumulative exposure to date, diurnal averages, day-of-week averages, pollutant ratios, pollution roses, trajectory analyses, etc - with regional & national maps of some of these - could all lend themselves to automation and informative graphic presentation. Since data analysis is often advocated up front and usually neglected later on, it might be useful to develop a "data analysis plan" in advance of implementation of the network, providing some thinking and proposed analysis activities to be conducted automatically or periodically with other supplemental data and expert analysts – with what objectives, by whom, and at what cost. There has been a major problem with the PAMS network deployment where there has been a considerable cost to collect data that have largely not been analyzed.

There is no description in the Strategy for a continuing mechanism for scientific input to the implementation of the Strategy and modifications to the Strategy as new information becomes available. The Subcommittee recommends that a standing scientific review committee be associated with the Ambient Air Quality Monitoring Program. The current Subcommittee indicated its willingness to serve in this capacity. The current subcommittee does provide the diversity of expertise needed on such a committee with the possible exception of epidemiology. We have recommended to the SAB Staff Office that this Subcommittee be charged with providing continuing advice on air quality monitoring to OAQPS and the Agency.

Overall, the Subcommittee again commends the EPA for developing a comprehensive air quality monitoring strategy, but is concerned about the many operational issues that will need to address as the strategy is put into operation. It therefore provides the following recommendations:

- Develop some degree of prioritization among the monitoring objectives. Separation into primary and secondary may be sufficient.
- Develop a guidance document to ensure that the monitoring network assessments have a reasonable degree of uniformity across regions and states.
- Utilize the existing spatial analysis tools as appropriate, but it again may be useful to develop a formal guidance document to describe the methods and their proper use so that results have a degree of uniformity across the country.
- Explore in more detail the applicability of satellite data that may help to support the spatial analysis of ground-based measurements.
- Since more of our remaining pollution problems are related to transported materials, it is

necessary to deploy more sites from urban areas to rural sires such that there is a better distribution of measurements that will support spatial analysis.

- Utilize the three tiered approach for sites ranging from one to a few species measurements at L3 sites to state-of-the-art monitoring methods at L1 sites.
- L1 sites will be essential as part of the network to test new equipment and to provide more detailed data for a variety of EPA regulatory requirements with respect to developing appropriate air quality standards to protect public health and welfare.
- Consider defining a limited number of specific goals for L1 sites rather than expecting them to support a wide variety of applications.
- Develop a plan for moving new technology that is developed and tested at L1 sites to the state and local agencies that will be operating L2 and L3 sites in support of their measurement needs.
- The number and distribution of the L2 sites was generally thought to be appropriate.
- Although there has been a valuable decrease in the concentrations of gaseous pollutants resulting in many fewer violations of the NAAQS for these species, monitoring needs to continue to support other needs such as input to air quality monitoring. In many cases, the monitors need to be upgraded to provide better measurements of the currently lower concentrations.
- OAQPS will need to upgrade its process of training and review of quality assurance/quality control processes in the SLT agencies that are operating the revised monitoring network.
- Although the subcommittee felt that the public information system that is currently in place is quite good, there needs to be a substantially improvement in providing access to the data for the public and researchers outside of the EPA and the SLT agencies. Such data access could also include some simple initial data summarization and analysis.
- Explicitly include the need to monitor in support of understanding welfare effects particularly from transported pollutants such as ozone and fine particulate matter.
- Coordinate the networks described in the strategy with other monitoring networks such as NADP so that there is better harmonization of available data among the networks.
- Establish a permanent scientific oversight for the monitoring program. Considerable resources are being expended and periodic review of the implementation and operation of the monitoring strategy and network will help to ensure that the maximum information return is being obtained from the resources being expended. The Subcommittee would be willing to serve in this capacity and in the interim, CASAC should serve as an oversight body.

In summary, the Subcommittee believes that the Strategy is a very important step forward for air quality management. It provides a framework for reshaping the air quality monitoring network to provide more useful data for a variety of purposes. A properly reconfigured network could provide better information for making the critical air quality management decisions that will be needed to protect human health, visibility, ecosystem vitality, crops and managed forests and materials. We would request that the Strategy document be revised to address the comments provided above and the revised draft provided to CASAC within four months. The Subcommittee looks forward to seeing the key guidance materials that will be needed to move the implementation process forward as well as reviewing progress as the network is reconfigured in accordance with this multiple objective approach. In addition, the Subcommittee recommends that EPA incorporate the modified approaches resulting from these Subcommittee recommendations into the regulations that are expected at the end of this year. Codification of the recommendations will help to ensure effective implementation. We wish the Agency well in this important endeavor.

Sincerely,

Philip K. Hopke

Dr. Philip K. Hopke, Chair
Clean Air Scientific Advisory Committee

Appendix A – Comments from Individual CASAC NAAMS Subcommittee Members

Appendix B – Roster and Biosketches of the CASAC NAAMS Subcommittee

Appendix A – Comments from Individual CASAC NAAMS Subcommittee Members

This appendix contains the preliminary and final written comments of individual members of the Clean Air Scientific Advisory Committee (CASAC) National Ambient Air Monitoring Strategy (NAAMS) Subcommittee who submitted such comments electronically. The comments are included here to provide the all suggested edits, a full perspective, and range of individual views expressed by Subcommittee members during the review process. These comments do not represent the views of the CASAC NAAMS Subcommittee, the CASAC, the EPA Science Advisory Board, or the EPA itself. The consensus views of the CASAC NAAMS Subcommittee and the CASAC are contained in the text of the report to which this appendix is attached. Subcommittee members providing comments are listed on the next page, and their individual comments follow.

Dr. Praveen Amar

July 14, 2003

Mr. Fred Butterfield
Designated Federal Officer
CASAC, NAAMS Subcommittee
EPA Science Advisory Board
U.S. EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Mr. Butterfield:

This letter provides my review comments on EPA's September 2002 draft document, "National Ambient Air Monitoring Strategy (NAAMS)."

EPA's strategy document is a commendable effort on the part of EPA staff to "overhaul" the existing monitoring structure from a fresh perspective with emphasis on monitoring of ozone, PM2.5 (and coarse particles in the future) and their precursors. The strategy document, to its credit, recognizes that we have arrived at the current state of affairs in ambient monitoring in an ad hoc manner by historically considering "one pollutant" or "one atmospheric or ecological issue" at a time. This has resulted in a patchwork of network that would benefit substantially from an integrated redesign effort that optimizes the strategy by taking into account locations of stations (including number and type of sites), instruments and monitoring methods, measurement protocols, data analysis and interpretation methods, and approaches to public outreach and information dissemination. Equally important, the strategy document recognizes that this process is dynamic in nature and needs to be flexible to incorporate new methods as they are developed in technologies of measurement and information transfer to many stakeholders including general public.

Before I offer technical and programmatic comments, I strongly suggest that the document (both the summary document and the complete report) would benefit substantially from a thorough technical editing job. There are many errors in the main document that distract the serious reader from focusing on the report. I have provided separate editorial comments on Chapter 1 (attached) of the main report. However, the rest of the report and summary document should be reviewed by an EPA technical editor for clarity and readability.

My comments are offered from the perspective of the state agencies that are actually responsible for implementing this network at the "ground level." The strategy, when finalized, has important implications for state and local regulatory agencies that are charged with achieving federal ambient air quality standards and protecting public health over the next several years.

It is appropriate to re-evaluate the design of network in response to changes in programmatic emphasis resulting from substantial decreases in concentrations of some criteria pollutants over the last three decades. However, states would be right in being concerned about certain aspects of both the technical and budgetary approach the strategy document is proposing to accomplish this.

I agree with the general thrust of the document in the areas of:

1. Increased flexibility in size and layout of network,
2. Reduction in PM FRM network allowing states to focus on other areas,
3. Emphasis on continuous PM monitoring, and
4. Formalizing the downsizing of the existing network through almost "zero-sum" financing.

However, the scope and overall complexity of the strategy will require many years of implementation effort. It would therefore be extremely important for EPA (and states) to make this long-term commitment to actually implement the strategy and taking care that this "transition period" has minimum impact on data quality that may result from "loss of focus."

The states would also like the strategy document to be more clear and specific in describing the venue for state's input to location of NCore sites (e.g., how would state/local/tribal (S/L/T) input on location be evaluated by EPA ?). It would be useful for strategy to include a formalized process under which site selection and approval for Level 1, 2, and 3 sites take into account SLT concerns as well as consistency with EPA's network design aspects.

In the area of funding the implementation of the NAAMS, the summary document needs to be clearer. For example, on page 19, the summary document notes the utility of "… steering agencies' matching portions of the Section 105 Grants toward local needs, separate from NCore." This approach may ultimately prove feasible, however, I suggest a more robust language to insure that once allocated by EPA, sufficient funds are made available for monitoring. One way to do this would be to codify this process in the regulations that EPA plans to prepare at the end of year 2003.

Another funding issue has to do with the "zero-sum" budgeting. Is the concept operational at the national level? Or, is the funding to remain constant at the EPA Regional level also? Also, as State and Local agency revenue shortfalls continue to climb, the likelihood of maintaining the current level of effort in ambient monitoring declines. One way to address this problem would be to include "Performance Partnership Agreements" in the strategy document to insure that adequate resources are allocated to monitoring.

The NAAMS includes performance-based QA programs. However, strategy should include the same concept for EPA's audit programs. For example, monitoring organizations with good performance record should be audited less frequently and should be allowed to institute "interstate" audit programs where sister sates, not EPA, audit each other. Another funding issue has to do with the challenge of transferring monitoring personnel to new tasks while disinvesting in some areas. The strategy needs to address the issue of funding training/retraining to accomplish this task.

One of my major concerns is about a lack of a well-articulated plan to undertake “technology transfer” from Level 1 (master or supersites) to Level 2 and Level 3 sites. The strategy statement (Page 1-6 of the main document) that “the perspective that a clear demarcation exists between science-oriented and agency-based monitoring is counterproductive to optimizing the collective value of research and air monitoring” misses the point entirely. The demarcation has existed in the US monitoring programs because we really have not developed consistent protocols and procedures to transfer high-grade science and technology coming out of the research efforts to the “ground level” routine monitoring performed by the state and local agencies. For example, states personnel would not be amenable to new technologies unless instrumentation has been proven ready for widespread deployment.

As situation stands now, there is a serious gap in transferring technology from high-grade scientific measurements to routine measurements. We need to recognize that for many cases technology transfer is not feasible because of constraints of budgets and technical know how of the routine monitoring personnel at the states level. However, where technology transfer is desirable and doable, this strategy document needs to lay out a well articulated plan that addresses procedures and protocols that are necessary to make this possible. Otherwise, the funding for Level 1 sites (that are currently unfunded) would be difficult to obtain if a clear case is not made for the long-term usefulness of Level 1 sites.

Another major concern is regarding how NAAMS should include the monitoring of air toxics. It is based on my understanding of the discussion that took place at our July 8-9, meeting, though I do not claim expertise in air toxics monitoring. It appears to me that based on recent measurements of air toxics and our understanding of air toxic risk assessment, a wholesale major shift to detailed air toxic monitoring (except for a few mobile-source related air toxics as well as particulate emissions from combustion of diesel fuels) is not warranted at this time. At a minimum, EPA should evaluate the results from the ten-city air toxics monitoring network and other monitored data as well as risk assessment data before making an informed judgment on how the NCore network should incorporate monitoring of air toxics.

Finally, I am concerned that the draft strategy is missing a major opportunity in that it almost does not mention the potential usefulness of this network for ecological-resource exposure. It lists “area-based ecosystem assessments” as eleventh out of 12 objectives and groups it with “diagnostic research” and other objectives. To the extent, the strategy is being designed when networks such as IMPROVE, CASTNET, NADP and MDN are already operational and all of which have been designed to characterize the exposure of ecosystems to various air pollutants, it behooves EPA to modify its NAAMS, where appropriate and feasible, for mutual benefit of existing and new monitoring programs.

Sincerely,

Praveen Amar
Director, Science and Policy
NESCAUM

Enclosure: Editorial Comments on Chapter 1 of the Strategy Document

cc: Dr. Phil Hopke, Chair, CASAC, NAAMS Subcommittee

Praveen Amar, NESCAUM
July 14, 2003

Editorial Comments on NAAMS (Chapter 1):

Section 1. Introduction, Page 1-1

Second paragraph, Third Line: Change from "academic priorities" to "science and technology priorities."

Line 5: Change "influx of scientific findings…" to "and emerging scientific findings…."

Line 7: "single-pollutant measuring approach"

Line 8 'change to "air quality management needs" instead of trends.

Line 10: (atmospheric deposition of acids, nitrogen, and toxic contaminants including mercury).

Last Line: add at the end: "in the late 1970s for one pollutant at a time."

Last Para, Page 1-1. The last three lines need to be rewritten for clarity:

"with the promulgation of the 1997 PM2.5 NAAQS. These networks experienced accelerated growth due to a large number of new sites for ozone and PM2.5, even though many other components exhibited declines in the number of sites." (This rewrite gives the correct picture of what actually happened).

Page 1-2 Line 2, change to "mass-only measurements". Also, to be clear, change the third line to "200 sites measuring mass on a continuous basis".

Page 1-2 , in b): First line change 'consists" to 'consist". Also, last line, change to " US Forest Service"
c) Research Supersites : change to " operated through cooperative agreements between universities and EPA that have operated over various periods spanning 1999 to 2003.. research-grade measurements. Supersites were designed to address the MORE COMPLEX" sampling

issues (instead of extremely complicated!)

3) CASTNET.
First sentence needs to have the year CASTNET started in the first sentence. Please say : CASTNET originally was deployed in the 1980s to account…."

4) PAMS:
The first sentence, as written, implies that ozone is formed ONLY at the sites !! Rewrite as : PAMS measures ozone and its precursors (VOCs and NOx) at 75 sites in 25 ….Amendments." Ozone is formed by the photochemical reactions between VOCs and NOx.
First sentence on Page 1-3 : has the word "addition" appearing twice. Replace the first "addition" by "deployment."
Third line : say "near-research grade measurement…."
Fourth sentence: please be clear: it is not summer ozone season" since it is from May 1 to September 30 (153 days). Replace by "ozone season (May 1 to September 30)."

5) Air Toxics Monitoring Network :
Please give the year of the "recently deployed pilot studies at four…." Is it 1999 ? 2000 ? 2001?
The second line from below in this write up " problems are NOT highly variable" but highly DIVERSE !. Also, just above, say "air toxics clearly ARE a problem" instead of "IS".
The paragraph starting with " Historically" needs to be written more clearly ! Say " Historically, as new monitoring needs HAVE developed… the focus HAS BEEN on specific pollutants.
Fourth line in this Para : change " … revision of air quality standards AND PROMULGATION OF NEW STANDARDS.."
Third line from below: delete "tribal" in SLT tribal representatives, HAS initiated….

1.2 Purpose
Third sentence: say " Assuming limited resources, at best,…."

Page 1-4: second Para. Please replace "optimize efficiency" with "IMPROVE efficiency."

Page 1-4, Section 1.3 : First line, say " recommendations INCLUDED in this document…"
Change the sentence under Technology Workgroup "…and provide a review of EPA's implementation plan for continuous PM measurements." This seems to be recurring problem in this document. The plan is NOT CONTINUOUS . It is the plan for CONTINUOUS measurements !! Please correct it wherever it appears.

Network Assessment Workgroup : Change to " culminated in a July 2001 workshop."

2. National Network Design workgroup: say "NCore" after National Core network.

Page 1-5 :
Under Air Toxics Steering Cmte : Say " development of a specific air toxics monitoring program…."

Section 1.4 Operating Principles :
Under “ Zero-Sum”. Define near future (2 years, 3 years, 5 years ? 2-5 years ?).

On Page 1-6, first Para. “flexible principles” should be replaced by “the concept of flexibility must also extend…”

5) Demonstrate the value of data:
Pleas replace “valueless” with “data of little value.”
Last sentence “one can only assume that the data have little or no value” needs to be rewritten. Say something like “it raises concerns about data utility or about lack of resources to analyze the data.”

6) Optimization through integration:
In the middle of Para., say “air toxic program currently under development…”

7) Effective Interface with “Science” : change to “Science AND TECHNOLOGY”
Third sentence: “important role science and TECHNOLOGY play…”

Second sentence from below : “science and TECHNOLOGY community as a partner…”

Page 1-8:
Point (2) :change to “continuous-measurement technologies”
Point (4) : what does it mean ? NCore should replace .. network TERMINOLOGY” What is this terminology ?
Point (6): Pollutants are not “REACTIONARY”! Please change to “reactive”.
Here and at other places, please add technology to science every time. It is important since they are two separate but important needs. So, here say “ scientific and technology needs”..

Page 1-9 :
Point (14): what do we mean by “flexible sites”? mobile sites ?
Point (18) :
Something is missing after “ enable NCore” . Do we mean enable NCore implementation?

Mr. Craig S. Beskid

14 July 2003

Mr. Fred Butterfield
Designated Federal Officer
EPA Science Advisory Board
US Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Fred:

The purpose of this letter is to transmit my review comments on EPA's "National Ambient Air Monitoring Strategy".

Overall this document is well written and reflects substantial thought, planning and effort by the agency and staff. They are to be commended for their thorough and comprehensive effort.

My attached review is organized to cover five major areas of the document. Those areas are: general comments; the objectives; the network assessment; the availability of data; and future implementation efforts.

I sincerely appreciate the opportunity to participate. If any clarification or explanation of my attached comments is required I will promptly provide them. Also, if assistance is required in writing or reviewing the sub-committee's response I am willing to participate in additional writing or reviewing assignments.

Sincerely,

Craig S. Beskid
President
Mickey Leland National Urban Air
Toxics Research Center

Enclosure
CSB review comments (14 July 2003)

cc: Phil Hopke

National Ambient Air Monitoring Strategy (NAAMS) Document Review

Craig S. Beskid
Mickey Leland National Urban Air Toxics Research Center

14 July 2003

The following are my comments and suggestions based on my review of EPA's "National Ambient Air Monitoring Strategy" document. Overall this document is well written and reflects substantial thought, planning and effort by the agency and staff. EPA should be commended for their thorough and comprehensive effort.

However, as with any complex effort there will be areas for improvement and different perspectives provided by reviewers. My attached review comments are organized to cover five major areas of the document. The areas are: general comments; the objectives; the network assessment; the availability of data; and future implementation efforts. Each of the areas and my review comments are provided in the following text.

General Comments

--EPA should expand its inclusiveness of the review of this document and the location of monitoring sites to include more citizen input, citizen data, private monitoring networks, local monitoring data, and business participation. Inclusion of these entities could expand the utility of the collected data, decrease the need for additional data, and improve the overall credibility of the process of the development of a national monitoring strategy.

--Has existing monitoring been evaluated relative to previous planning and siting efforts? How effective has the monitoring been at achieving the original goals as presented in the original plan? This will provide some insight as to the focus and direction of the current monitoring strategy.

--The document is authoritative and factual. This is desirable and an advantage; however, discussion of uncertainties and limitations (where warranted) would enhance the credibility of the document and provide a more meaningful assessment of the utility of the strategy.

--Base more of the strategy on the measurement of health effects in local communities. This means more short term measurements, measurements of more compounds and relationships to personal exposure and air toxics.

--Make the document shorter by reducing the over 600 pages to a readable Executive Summary document.

Objectives

--Too many objectives. Select and limit.
--Current objectives too broad.
--Need to prioritize selected objectives.
--Link objectives to schedule and budget; match priorities and timing to show progress.
--Need more sites specific to the identification of public health effects. NAAQS is driven by the protection of the public health and welfare but sites target ambient measurements. Current techniques must be updated to reflect the current state of the science for measurement of health effects. Link ambient measurements to personal monitoring.

Network Assessment

--For the NCORE sites I suggest that EPA maximize the science value of the sites by co-locating sites in areas of ongoing personal monitoring. This can be identified through cooperation with University researchers and state officials.

--Add a matrix to the document that lists the sites, species measured, their purpose and location.

--I suggest that 2 to 3 L1 sites be for technology demonstration and 2 to 3 L1 sites be designated "regional" sites. No greater than 5 L1 sites total.

--Clearly define the incentives to states for reduction in O3 monitors vs. data loss (i.e. O3 is a regional pollutant and can be measured well over a regional with fewer sites. Other pollutants are more localized and more sites would give a better profile).

--Provide a measure of geo/temporal and measurement uncertainty for each site.

--Discuss more of the need for training of state and local monitoring personnel.

Availability of Monitoring Data

--Provide data for purposes beyond compliance assessment.

--I suggest that EPA acquire and use the new generation of information technology tools to make all monitoring data available to all users.

--Provide better discussion of the linkages to and usefulness of monitoring data to the various EPA and State modeling efforts. Use modeling data needs as a component to define monitoring needs and locations.

Implementation

--Consider incentives for private monitoring in the form of regulatory relief or postponement of regulatory implementation. States such as Texas have implemented this idea successfully and increased the access to monitoring data at lower public cost.

--The overall strategy would benefit from a description of a component of the strategy to reserve some monitoring resources for “unplanned or unforeseen events”. In any long term strategy it is hard to cover all future events. By recognizing this fact and planning and reserving resources to address unplanned and unforeseen possibilities, the monitoring strategy is improved by being more responsive, flexible, and credible.

--Specify a phased (or pilot) implementation of the NCORE concept to identify benefits, weaknesses, and emergent technologies prior to full scale implementation.

--Identify other entities (States, Research Organizations, NPS, NIEHS, NOAA, NWS, etc.) involved in monitoring and leverage resources with these entities during routine or large single purpose monitoring programs.

I sincerely appreciate the opportunity to provide comments to EPA on this important effort. If any clarification or explanation of my comments or suggestions is required I will gladly provide them. Also, if assistance is required in writing or reviewing the sub-committee’s response I am willing to participate in additional writing or reviewing assignments

Dr. David Diaz-Sanchez

National Ambient Air Monitoring Strategy (NAAMS) Review

University of California, Los Angeles

General comments

In general this is a well written and thoughtful document. However, it is obviously an incomplete one that has many specifics left to be finalized. The goal of the document is not to provide details on all aspects but to provoke input on the general strategy before establishing the network. Exactly how much input is required in the details will presumably be addressed in the meeting. My comments will therefore concentrate on issues that represent talking points and questions which could benefit from clarification from the EPA staff during the meeting so as to better assess the strategy.

These comments are made principally from a health effects standpoint.

Resources

Much is made of the fact that the Strategy will operate within a zero sum constraint. It is unclear whether divestments will fully cover the cost of the new network e.g. retraining of staff to data management, QA etc. A zero sum assumption in resources although politically attractive may result in severe limitations of flexibility. A modest initial investment of 8-20M is envisioned to cover the cost of new Level 2 monitors. It is unclear if this has been properly budgeted or instead represents a best guess at this stage. The emphasis on multi-pollutant monitoring is a laudable approach. However, I am concerned that given the range of endpoints needed to be covered (continuous N,SO2,CO, PM2.5, PM10, O3; PM2.5 FRM, Meteorology), the proposed changes in information technology, and the retraining needed to accommodate these changes, the proposed investment will be insufficient. Moreover, information technology (and to a far lesser extent monitoring) is a rapidly moving field. New techniques and capabilities are sure to arise in the very short term to facilitate the goals of the Strategy. How will these future techniques be accommodated? The document states that capital costs for new pollutant monitors will be covered by further divestments in existing Level 3 or special funding. This seems unrealistic and opens up the possibility that in the need to make zero-sum, cuts in monitor numbers may be made on financial rather than scientific basis.

It is worrisome that funding for Level 1 sites has yet to be identified. The current supersites have been successful etc but have been focused on PM. The proposal envisages a significant increase in scope and function. This will be expensive given the level of expertise needed. Given that a budget of only 2-10M is envisaged, a smaller number of well funded sites would be preferable.

Accountability/Implementation

The issue of accountability is dealt with in only a superficial way. For example, as stated above, it is important that future divestments be scientifically defensible. It is unclear what mechanisms will be in place to judge whether this is indeed the case. In general it is unclear how implementation of the Strategy will be overseen. Given that the Strategy envisions different agencies monitoring should oversight be performed by a multi-agency panel?

Monitor numbers

A key element of the Strategy document is the divestment and re-investment of monitors that appear to be redundant. These monitors are classified as that if they are in areas which are not thought to be likely to exceed air quality standards. However, underlying this approach is the unstated belief that these standards are valid and are fixed. There is considerable controversy in the respiratory health arena whether many of the standards are rigorous enough and actually reflect our current knowledge of the health impact of these pollutants. In particular, there is a growing realization than there exist sub-populations, which due both to extrinsic and intrinsic (e.g. genetic) factors maybe at increased risk to pollutants' deleterious effect. Given the interest in both the scientific and community regarding these types of issues, it is likely that air quality standards for many of the pollutants will be revisited either in the short or long term. In this constantly changing field, much research is being done on long term low levels. This begs the question of what happens if standards change. Will there be a need to reintroduce monitors? Given a zero-sum policy how will this be financed and how will these decisions be made?

Dr. Kenneth L. Demerjian

Comments on the National Ambient Air Monitoring Strategy Draft Document

CASAC NAAMS Subcommittee Meeting July 8-9, 2003 Research Triangle Park, NC

Overall the goals/objectives of the strategy document are commendable and if successfully implemented will improve the quality, effectiveness and responsiveness of EPA's national monitoring networks. In reviewing this document the committee was asked to provide comments on three specific areas: 1) the NCore proposal and associated tiered monitoring system; 2) the use of spatial analysis approaches for network design and other planning needs; and 3) the use of performance based approaches for standardizing monitoring method requirements for instrumentation.

In addition several specific questions have also been raised by the NAAMS Chair for consideration and these included: a) Are all of the potential uses of the output of air monitoring adequately reflected in the objectives? b) Are the methods outlined for assessing network design and performance appropriate and likely to be effective? c) Are all of the critical species identified? d) Is the spatial strategy adequate to address the appropriate level of heterogeneity of source emissions, transport and chemical processes? e) Are the processes for scientific input and review appropriate and adequate? f) Is the strategy laid out in a way that provides appropriate mechanisms for evaluating trade-offs between competing objectives and thus deploying a network that maximally meets the national needs?

The three specific areas outlined in the charge to the committee have been explicitly addressed in this response and most questions raised by the Chair implicitly addressed as well.

As a general comment the Final Draft September 1, 2002 National Ambient Air Monitoring Strategy Summary Document should to be updated to reflect changes in schedules/timelines as a result of delays in the process and revised best estimates of the Strategy Timeline provided in Table 5.

NCore Proposal and Associated Tiered Monitoring System

The NCore tiered measurement construct (Figure 3) is reasonable, but should consider the following changes. The Level 1 core sites should not be identified as an unfunded activity; they are a critical component of the strategy document and instrumental to the network monitoring assessment process. Such an approach totally undermines the credibility of the strategy. A discussion of a proposed hypothetical 6-8 site level 1 deployment highlighting the various attributes and expectations for specific sites within this specialized network is in order. It will not only help communicate the importance of these sites to the strategy, but should also attract stakeholders in support of this unprecedented approach. The distinction between level 2 and level 3 sites is too restrictive. It is quite possible that multi-component measurements at level 3 are both needs driven and cost effective. The level 3 discussion should be modified accordingly. It is important to communicate that the NCore network is the "backbone" of EPA's basic monitoring activities and serves critical but not all the needs of the various user communities. As such EPA has and will continue to augment special measurement studies that build on the NCore foundation to address special purpose user needs outside of NCore's principal domain. [Some examples might include: emission compliance monitoring (tunnel, vehicle chase, and/or crossroad measurement studies); hot spot characterizations; or the characterization of air quality as a result of major local emission perturbations.] The distribution of NCore Level 2 Sites presented in Table 2 is reasonable, but the table needs some work. The "vertical" Total column does not add to 74. The table would be less confusing if column one read " an additional 2 in most populated states" and "an additional 1 in second tier…"

The proposal needs a table that summarizes NCore measurements (and related site levels) versus associated prioritized user needs to be addressed by the network. For example

Prioritized User Needs	**Measurement Parameters & Principal Site Level**	**Rationale & Required Analyses**
Trend Determination & Assessing the Effectiveness of Emission Reduction Strategies[1]	VOC, NOx, NOy, SO2 - (Level 2) Ozone, PM2.5 (Level 2 & 3)	Accountablity; times series analyses
NAAQS Compliance		
Health Assessment		
…… etc.		

[1] These two tasks require similar data sets and analysis techniques, but could be separated and treated explicitly.

NCore and its Relationship with other National Monitoring Networks

The strategy document should provide a more detailed discussion regarding complimentary monitoring networks (NADP, IMPROVE, …) and their role in meeting integrated user needs of the environmental community. The CASTNET description provided in Addendum A is unclear as to its current role and importance to the NCore strategy. CASTNET has been reinvented several times since its original design, and many would suggest that its evolution has been more negative than positive. A clear understanding of its integrated role and/or further evolution should be spelled out in this document.

Monitoring Network Assessments

Technical assessment of the NCore monitoring system and process therein will ultimately decide the networks success or failure. These assessments must be in depth and on-going bringing together various stakeholders (state monitoring scientists/operators, measurement community including commercial instrument vendors, data analysts, and the various end user communities). An annual meeting with specific themes should be organized to assess selected strategic objectives and specific hot button issues that have surface during the year. The PM Supersite program has successfully demonstrated through its annual meetings of PI's, that such gatherings are extremely effective in assessing progress, communicating and sharing critical knowledge and in problem identification and resolution. It also essential that Level 1 site teams play a major role in these technical assessments. The strategy document suggests that national assessments be conducted on a 2-3 year cycle. This timing is acceptable for the preparation of formal reporting document that meets a "agency regulatory/bureaucratic" need, but does not address technical assessment process that must be implemented. This process must be continuous and evolving, it must bring together and inform NCore stakeholders and assure their participation and sustained shared interest in the goals and objectives of the network. The network assessment process is closely tied to defined user needs and associated data quality objectives to meet those needs. This in turn is closely coupled to an effective quality assurance program. There are many open QA issues associated the measurements technologies for PM2.5 mass and its chemical speciation that must be addressed if we hope to achieve the data objectives necessary to meet NCore user needs. Preparing QA guidance documents is necessary, but not sufficient. There is substantial quality assurance development work that must be part and parcel of the NCore strategy. This work is non trivial and costly, but essential if the network is to have any credibility. It includes, for example, establishing calibration facilities and standards for PM measurement technologies, instrumentation testing, evaluation, and intercomparison, and the development of standard operating procedures and related data reduction and processing techniques.

Spatial Analysis Approaches for Network Design and Other Planning Needs

The spatial analysis techniques described in NAAMS work best for the secondary longer lived pollutants (PM2.5 and O3) chosen which are typically quite homogeneous. Assessing the spatial representativeness of individual sites within a dense urban monitoring network using interpolation and statistical weighting functions can be quit useful in determining the valued added information provided by any specific site. Unfortunately, the technique it is not prognostic and has no explicit relationship with source-receptor and physical and chemical processes that affected the measured components. As such, these techniques do not provide insight to as what would be the best placement of a monitor to best capture exposure outside the existing monitoring domain. The spatial representativeness of monitors is established somewhat by design and as such one could argue that the effectiveness of spatial scaling is somewhat tied to original network design. For example, monitoring for hot spot exposures of CO or a specific source oriented air toxic is not likely to fair well in spatial extrapolations across an urban/regional domain.

Techniques to estimate pollutant exposures from PM chemical speciation measurements, which for example are sampled every third day on a 24hr average remains a significant challenge to user community.

Application of Performance Based Approaches for Standardizing Monitoring Methodologies

In principal the development of a performance based measurement process linked to data quality objectives is commendable. This again as with the quality assurance discussion, requires a substantial investment of both federal and SLT resources to accomplish. It is not clear that program has realistically addressed the costs of these and other aspects of NCore.

Data Availability and Exchange

The success of NCore will depend very much on the timeliness and easy of data access. Historically EPA data access and data mining limitations have discouraged use by the broad scientific community and raised questions about its quality and utility. The NCore must have a data management system that facilitates access to raw data archives and associated data quality parameters, provides access to semi real-time value added processed data (over limited timeframes), and selected visualization and analyzed data products tailored to respective stakeholder user communities.

The success of an open and effective technical assessment process is contingent upon addressing the data access issue.

Concluding Remarks

The development of a National Ambient Air Monitoring Strategy is a very important and long overdue. The strategy provides a framework and process, which if properly supported, will improve the quality and effectiveness of the agency's air monitoring. It also provides the opportunity to periodically assess the network's performance, and guide its evolution in a timely manner as technology and priorities change in air monitoring. Although the strategy addresses all the critical elements for a national network, its success will ultimately be tied to the implementation and the details therein. The development of an implementation plan for the strategy over the next several months is in order. The plan should identify key steps regarding STL interactions with regard to establishment of the Levels 1-3 NCore sites, identification and organization the first technical assessment (e.g. this might focus on continuous mass monitors and STN measurements); a realistic assessment of resource allocation for critical tasks identified in the strategy (e.g. cost trade offs associated with level 1-3 monitoring sites, QA related activities, performance based methods assessment, and data management, distribution and processing activities) and the management structure to effectively sustain the on-going technical assessment process.

Dr. Rudolf B. Husar

Comments by R. Husar, Washington University, July 9, 2003, RTP

The NAAMS initiative is a **bold** undertaking by the agency to make the air monitoring more agile and responsive to the Agency's and Public's needs. I support the ideas in NAAMS fully. Both of my comments below are directed toward broadening the scope of the Strategy

1. **Add (more) assessment to NAAMS.** Monitoring and assessment should be tied more closely. The real information value of the network is generated not just by the instruments but also by the thoughtful processes the turn the monitoring data into usable, (actionable) knowledge. The equally agile assessment (for the various goals of the network) should be done in parallel with the sampling, data collection and archiving. Is it too late to consider a National Ambient Air Monitoring and *Assessment* Strategy? (NAAMAS)

2 **Integrate closer with NASA, NOAA.** It is clear that the function of the new network for regulatory support has to follow strict guidelines, FRMs, schedules etc. However, all other applications could benefit from increased integration and use of non-EPA data resources. NASA satellite data are already used by many researchers and state analysts to track the pattern of dust, smoke and haze. NOAA weather data, i.e. 1 minute resolution met parameters from 1000+ ASOS visibility sensors, could aid the spatio-temporal coverage of particulates during extreme events or emergencies. This would add just one more tier (external data tier) to the attractively tiered NAAPS concept.

Mr. Richard Poirot

National Ambient Air Monitoring Strategy Summary Document
September 1, 2002 Final Draft for Comment
CASAC Review Comments, R. Poirot

Overview
The Strategy document represents a timely effort by EPA to re-think and revise our national approach to routine air quality monitoring. To a large extent, the current national network has been established over several decades to meet the single primary objective of determining compliance with NAAQS for a small number of "criteria pollutants". But even as compliance has been achieved for the majority of these pollutants, and as the scientific understanding of new important pollutants, precursors and pollutant interactions has evolved, the network has not evolved accordingly. The Strategy seeks to break down the resistance to change of an aging routine program, reduce the inertia of the status quo, and create a more flexible and responsive program for the future.

EPA can also be commended for the process by which the strategy has been introduced, discussed, revised and refined to its current form. Since a majority of routine air monitoring activities have initially been required by EPA but delegated to state, local & tribal agencies (SLT) for implementation, EPA has been prudent to actively engage its SLT partners in strategy development, review and revision. This interactive process has been rigorous, and has extended well beyond the intense discussions within the NMSC to include frequent discussions in various local, regional and national forums. The current strategy, as summarized in this document, has reached a midpoint between concept and implementation and EPA is currently seeking feedback from the scientific community. Are we on the right track? Yes, in my opinion, this is an excellent start. Although it should be recognized that there will likely be many devils in the details of implementation.

Costs
The "zero sum game" may be a necessary constraint, but here are a few cautions.
- Ambient monitoring constitutes a substantial fraction of all SLT air program budgets (60 % in VT for example) and major shifts in specific SLT allocations will have unpleasant consequences for the losers.
- EPA funding which supports ambient monitoring is primarily for equipment purchases, while SLT constraints are largely for personnel costs.
- Many SLT are currently facing substantial budget shortfalls, and are less comfortable with deficit spending than the current federal government appears to be.
- I think the assumed cost savings from eliminating redundancy may be optimistic, particularly since (largely as a result of this strategy development) considerable downsizing and consolidation has already occurred in many areas. A related issue is that many existing sites simply don't have the room to add additional equipment and may need to be moved ($$$) rather than expanded ($).

- Level 1 sites are included in the strategy, and seem critical to its longer-term evolution and success, but are unfunded. This is a problem.
- Incentives need to be provided to encourage & enable SLT to upgrade sites that may not meet the "Level 2 site short list". Adding individual components or non-standard measurements at level 1 sites should be encouraged, not discouraged.

Emphasis on Continuous Monitors at Fewer Multi-pollutant Sites
- This is an excellent concept, which I strongly endorse. Our ability to better understand pollutant sources, their chemical & physical interactions, and their effects on health & environment – and to effectively communicate this information to the public will be strengthened.
- Continuous methods can reduce labor costs, reduce some of the sampling artifacts that can affect filter-based and canister methods, and can minimize sampler malfunction periods with earlier detection of problems. However:
- Better temporal and "relational" detail will come at the expense of spatial detail. Other approaches will need to be developed to clarify complex spatial patterns.
- Additional consideration needs to be given to more precise definitions of what is meant by the term "representative site" and to do a (much) better and more uniformly comprehensive job characterizing the detailed features of existing monitoring sites, especially those selected as or established as NCore Level 1 or 2. Since a majority of NCore sites are urban and proposed as one site/per urban area, I think it will prove to be very challenging to select these sites in a consistent manner across the country (where would you put "the NYC site" or the "LA site" for example). Also, there are relatively few current ozone monitors within major urban areas (most are outside of downtown high traffic areas) so many new (or moved) ozone monitors will need to be deployed at Level 2 sites, and these will (differ from the majority of Level 3 ozone sites, as they will) measure ozone reduced by substantial local NOx scavenging.
- All things being equal, it would be desirable to locate rural Level 2 sites at existing IMPROVE or IMPROVE protocol sites. But if urban level 2 sites are located at STN speciation sites, there will be substantial inconsistencies between the urban and rural PM speciation data. Since a relatively small number of Level 2 NCore sites are planned with common minimal configurations, some consideration should be given to requiring standard equipment at these sites (i.e. we don't want a mix of CAMS, BAMS, RAMS and various TEOMs across the NCore sites).
- Emphasis on development and implementation of new, innovative methods is desirable, but is likely to conflict in some cases with the objective of characterizing long-term trends. Decisions on methods changes and multiple methods for the same species need to be very carefully considered. Particular caution should be taken to avoid pushing widespread use of new technologies that have not been adequately field-tested (PAMS, for example). Because things can and do go wrong with new (and old) sampling methods, and because information transfer and archival technologies are improving (& strongly emphasized in this strategy) care should be taken that all the relevant data relating to sampler operation and performance can be captured, transferred and archived.
- Not all species of importance lend themselves to continuous sampling. Consideration should also be given to development and deployment of methods which can collect larger sample

volumes over longer sampling intervals – for example to allow more detailed organic speciation of PM-2.5. Such methods need not be labor intensive (in the field) and might lend themselves to automated linkages to the continuous instruments and/or collocated met instruments.

- Meteorological measurements are emphasized as a component of Ncore (good!), but collocated met data is always mentioned up front but often neglected or poorly implemented at air monitoring sites. This needs careful attention. Siting met instruments at urban sites is difficult logistically, and met. QA/QC guidance and procedures are often neglected.
- There is an inherent conflict between fewer sites with continuous methods and the continuing objective of determining compliance with NAAQS. To a certain extent, inefficiencies and scientific inadequacies in the current network are directly related to the specific methods by which compliance is determined and then attributed (illogically) to the specific political jurisdiction in which a monitor is located. I think some reconsideration and possible revision to the methods of compliance determination could be a helpful – possibly necessary – parallel effort to a revised monitoring strategy. Revisiting the concept of spatial averaging might be one way. Rethinking the current metrics of compliance and the "bright line" yes/no attainment test seem like possibilities. Considering the "no threshold" characteristic of the dose/response relationships for both ozone and PM-2.5 (and almost certainly for certain toxic pollutants as well), the concept that a population is unaffected if ozone at a site in their political jurisdiction (what is it – 4th highest daily 8-hour max ozone level averaged over 3 years?) is 849 ppb , while their neighbors are all dying at 850 ppb is silly. Maybe a broader "too close to tell" category with requirements to "make progress" (over a broader "region of influence") is a feasible approach.

Data Transfer, Distribution and Analysis

The strategy calls for a strong emphasis on efficient procedures for rapid (automated) QA/QC and technology for rapid data dissemination and public reporting. This is highly desirable, and should specifically exclude anyone who's had anything at all to do with the continuing data disaster of the "New AIRS" system.

- The AIRNOW ozone mapping (and early efforts with continuous PM mapping), and various state & regional "real-time" data web sites have been well-executed and extremely popular with the public. This kind of fast information can also be valuable to the scientific community, particularly if access can be provided to the data (not just the AQI-disguised, color coded, health-messaged map images) and if there were an associated data archive (much real time information is available either real fast or real slow (AIRS), but getting access to last week's real-time data is often impossible).
- Certain aspects of "routine data analysis" could also lend themselves to automation. For example: calculations of daily, weekly, monthly, seasonal and annual means, percentiles, exceedance counts, cumulative exposure to date, diurnal averages, day-of-week averages, pollutant ratios, pollution roses, trajectory analyses, etc - with regional & national maps of some of these - could all lend themselves to automation and informative graphic presentation.
- Since data analysis is often advocated up front and usually neglected later on, it might be useful to develop an advance "data analysis plan", providing some thinking and proposed analysis activities that conducted automatically or periodically with other supplemental data and expert analysts – with what objectives, by whom, at what cost…

- As a complementary effort to NCore continuous measurement and reporting, it would be highly desirable to develop and deploy the best available continuous ozone and PM air quality forecast models (that are sufficiently non-resource-demanding that we can afford to run them continuously. I think too much of our national modeling expertise is focused on the most complex, best possible high end models and met fields and emissions data – that are too limited in distribution and/or too slow in computation to run for more than the occasional 10 year old week-long episode. An effort needs to be made to run the forecast aerosol & ozone models continuously, link these outputs to the continuous measurement data, and conduct and display continuous model/measure comparisons.
- While many emissions data may not be available in real time, surrogate estimates can be developed & refined, and certain sporadic emissions sources – like fires and dust storms can be identified by remote sensing and entered as real-time model input. The resulting continuous model/measure comparisons would also provide an excellent means of identifying features and causes of model miscalculations and lead to rapid improvement of "routine model performance.

Missing Parts & Partners

- Since Level 1 sites seem critical for continued methods development and testing, but are unfunded, some creative funding mechanisms and/or partnerships may need to be developed. Possible partners might include private industry, ORD (a missing presence in meaningful methods development in recent years), other federal agencies (DOE, DOT, NOAA, NPS, etc.) Since Level 1 sites can potentially represent a large "windfall" to cities, states and nearby academic institutions where the (few) are located, some consideration should be given to periodically moving these Level 1 sites to different locations in different regions.
- Vertical Information is a missing component, but might be added at modest cost with existing technology.
- Collocation with other network instruments (shadow-band radiometers, wet & dry deposition, ASOS visibility, IMPROVE nephelometry & transmissometry, WebCams, automated traffic counters on surrounding streets) and links to various remote sensing systems (satellite, lidar, etc.) could substantially enhance the information content of both NCore and these other national networks. A future key to better understanding will be better coordination & synthesis of multiple aerosol and ozone related information sources.

Dr. Armistead (Ted) Russell

In regards to initial thoughts, concerns, etc. about the NAAMS strategy, first, I must applaud the group for their efforts. I am strongly in favor of having fewer total sites with more complete sets of instrumentations. The current network is not anything near optimal, but one can see how it got there.

One of my initial concerns is that a major driving force for network reduction (as opposed to redesign) appears to be the desire to conduct air toxics monitoring. I would like to see how significant this is compared to the other air quality problems. A recent analysis we did in an area that is suspected of being high in air toxics, but is in attainment (just barely) of the O3 and PM NAAQS, suggests that the air toxics problem is an order of magnitude less important than PM (possibly more) and still less than the ozone problem (we used valuations from the literature). Thus, any reduction (as well as the redesign) should look at the big picture of protecting human and environmental health.

As part of a recent NRC panel (on CO in topographical and meteorological problem areas), the panel concluded that one should resist the drastic reduction in CO monitoring just because most (virtually all) areas are coming in to attainment. First, CO is an indicator of other motor vehicle pollutants (as is noted in the NAAMS). Second, there are recent health studies showing associations between CO and various health outcomes at levels below the NAAQS. (First, this suggests that monitoring below the current NAAQS may be important if the standard should be lowered (doubtful), and more importantly, we need to maintain such monitors to allow health researchers to conduct such studies.) Third, they are important for emissions trends assessment, and emissions inventory evaluation. Fourth, some non-attainment areas pop-up (e.g., Birmingham). Fifth, there still may be hot spots out there that need to be monitored. These arguments are not specific to CO. This does not say that we should not touch the CO (or other) monitors, but that they have a multitude of uses, and as the report states, one should consider keeping the monitors in place in a cost effective fashion. The NAAMS comes to a similar conclusion, but seems to be more oriented to reductions than I would. I applaud their move to continuous monitoring. From virtually any stand point, save regulatory in determining compliance with the NAAQS, continuous monitoring is more informative and cheaper. One problem is the lack of a continuous metals monitor that can be used for monitoring. I like their move to allowing REMs. It would be good if they could go even further, reducing the reliance on PM FRMs even further, e.g., reducing the stringency in terms of numbers of FRMS, how to certify REMs, etc., to further motivate the use of continuous methods.

While I am on PM monitoring, one part of their strategy should be to take extra filters, even in places where they are using continuous PM monitoring, and archive them for some future analysis. This could be done once every six days such that somewhere down the road if a new analysis technique is developed, we do not have to wait three years to get enough data to do source-trend analysis using the new methods. You can already get the add-ons inexpensively, and the filters could be collected when the instruments are checked.

Their allocation of NCORE Level 2 sites is reasonably well thought out, and like they do, I, too, would reconsider having three sites in Florida since it is so non-characteristic of the rest of the SE region (or the rest of the US). Also, like people, there is a concentration of extra monitors in the upper midwest. How representative the ultimate network is, however, depends heavily, on where the rural montiors are located. Their analysis of airsheds is a good start, and the exercise on the value of information for the existing network is good, and should be extended to how the Level 2 sites are ultimately placed.

In regards to their SuperSite placement decisions, I would consider having specific missions for the individual sites. One could be more for method assessment, another for background air characterization, another (one or two) for health assessments. While they could take on other objectives, having a specific primary objective would make the individual sites more focused.

A question... why do the monitors have to operate at 1 minute intervals to support exposure assessments? Is this a real need?

Dr. Roger L. Tanner

Comments on EPA's National Ambient Air Monitoring Strategy

Comments distributed at the NAAMS Subcommittee, July 7, 2003:

Overall, this is a welcome strategic document explaining where EPA's monitoring strategy has been, why it needs to be updated, and includes a reasonably complete and thorough expositing of why the proposed changes have been made.

There are three categories of change which I see as the most crucial of EPA's proposals:

- multi-pollutant monitoring incorporating the several, now quasi-independent pollutant monitoring programs;
- substituting of continuous monitoring for PM and its constituents for a major portion of the present filter-based monitoring;
- assuming a zero-sum budgeting situation, deciding which monitoring programs could be curtailed to allow for the expansion in continuous monitoring activities.

In general, I support the first two of these proposed types of changes with few reservations. It has been clear to me that the degree of interactions between regulated pollutants is so extensive and the implications of these interactions on overall air quality so profound, that integrated, multi-pollutant monitoring and supporting atmospheric science research is the only sensible approach. It is also clear that continuous monitoring approaches are not only becoming cost-effective, they add knowledge of the processes controlling air quality that will materially aid in future regulatory decisions. I do not agree that zero-sum budgeting of monitoring activities is either justified or prudent, but going forth with the development of a strategic monitoring plan based on that assumption is a sensible approach to improving national monitoring activities.

I enumerate below some specific problems I have with the document and the plan in a separate set of comments, and include here some comments on general, potential deficiencies I find in the document.

One critical element of the plan to substitute continuous monitoring of mass (and likely constituents thereof as well) for a portion of the filter-based network for fine mass depends on the Agency's ability to demonstrate that a means to determine which monitoring sites can be eliminated without major loss in the networks' abilities to quantify of regulated pollutant levels. The degree of correlation between levels a several sites are indicated as the means to parse, at least semi-quantitatively, which sites could be eliminated. I do not yet understand how this will be done, and what averaging periods would be appropriate to make such determinations. Given the seasonal and diurnal variability of fine mass and its constituents, this would seem to be more difficult than the document implies. The situation seems more complex than the ozone monitoring case, where local sources of NO lead to lowered and varying ozone levels in urban areas. In that case, the local attenuation of ozone means that fewer urban sites are needed since those are not where the higher ozone exposure areas are likely to be located. But in the case of mass, the concept of a regionally representative continuous monitor seems a bit of a stretch, and it is not clear to me how well this concept has been thought out.

A more restricted criticism that I have is in the matter of the measurement of NO2. I applaud EPA's recognition that NOy is a metric that must be monitored, and that the difference between NOx and NOy becomes more critical away from central cities. However, I don't yet see a commitment to get to the point, and quickly, where we can routinely monitor NO2 or even NOx cleanly in the presence of other NOy species. I think this is critical both because NO2 is a criteria pollutant but because of its key role in ozone formation. I suggest we take some effort to get routine NO2 monitors (likely based on photolytic converters) into the field pronto in a form that STP staffs feel comfortable with operating. This is long overdue!

I like the 3-tiered approach in general and think that if properly integrated vertically, it could be very valuable. I also agree that Level 1 sites need a significant stable source of funding, although EPA has not yet identified same. It would be adventitious if EPA would considered the range of potential "supersite" contributors to include other Federal agencies, state agencies and private concerns in addition to the strictly grant approach in which university consortia are the main actors.

In the area of siting, there is an expressed need for at least one rural -based Level 1 site and 1-20 rural/regional based Level 2 sites. I am curious as to the role to which IMPROVE and CASTNET networks might play in fulfilling this need, but I could not find any significant discussion in the Strategy on that point.

<u>Additional Post-Meeting Comments, 7/11/03:</u>

I agree with the general consensus that too much emphasis was placed in the monitoring plan on the upcoming HAPS regulations and their implementation. I believe that some modification of the plan will be needed for whatever regulations come down the pike re HAPS, and that the modifications that will be needed will be pollutant specific because of the heterogeneous group of chemicals which have been lumped into that category. It is thus better to have a flexible strategy for continuous updating of the monitoring plan as new implementation realities for HAPS become codified and made real to the regulated community, in contrast to coming up with a detailed monitoring strategy now, necessarily based on regulatory approaches still on the drawing board.

In regard to this need for a flexible strategy which can adjust to new realities, I am still concerned in a major way about the absence of a funding mechanism for the Level 1 sites. Whether or not the Plan's structure is a pyramid or a "wedding cake", it will still in my view require a formal strategy and a broad and transparent funding plan for Level 1 sites based on identified measurement needs which cannot be met by instrumentation available today. This should include an early attempt to identify the agencies and other stakeholders whose required monitoring needs will be better served with newly developed instrumentation. (This was PAMS "Achilles' heel" and need not be repeated.) EPA's other essential role (besides co-funding Level

1 efforts) is to explicitly fund training State and Local folks in using the new technologies as they come on line.

Dr. George E. Taylor, Jr.

10 July 2003

Mr. Fred Butterfield
Designated Federal Officer
EPA Science Advisory Board
US Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Mr. Butterfield:

This correspondence is a cover letter to my review comments on EPA's "National Ambient Air Monitoring Strategy". A draft of my review comments was provided to you at the meeting (disk copy) and I am attaching a hard copy herein. The disk copy is the same as the hard copy.

Whereas my written review covers a range of issues of varying importance, there are three that warrant a priority in this cover letter.

The first is the absence by the Agency of a commitment to welfare effects, including natural resources (e.g., agroecosystems, forestry, fisheries), human well being (e.g., recreation) and the intrinsic value of ecosystems. From my vantage point, there is concern in that the Agency confirmed that they did not include ecology and natural resources because there was little constituency in the Agency arguing for their inclusion. The Agency has a legal mandate to address welfare effects. The development of the strategy without this legal mandate needs to be addressed proactively and aggressively by the SAB and this is not the first time that the Agency and OAQPS have expressed a similar posture. As expressed at the meeting, I am unwilling to commit on the strategy in terms of the number of sites and level of instrumentation until the Agency clearly articulates what resources it intends to commit to ecology and natural resources. Failure to address this issue now will dictate that the NAAQS can not address welfare risk for the foreseeable future.

The second is the issue of information technology (IT). The IT component is not at the state-of-the-art position as it needs to be. The IT community has a number of new capabilities that are critical to the success of the strategy, including knowledge mining, data base management, data fusion, distributed data base access, on-the-fly interface with the modeling community, and linkage to risk communication.

The third is the lack of emphasis on scaling versus monitoring and the role of complementary high technology methods. From my vantage, scaling needs to be elevated to a position of parity with monitoring, and the argument is simply that scaling continues to be one of the major sources of uncertainty in the risk assessment. Significant enhancements in monitoring alone will likely fail to improve the risk assessment significantly unless the scaling issue is addressed. New tools and more integrated systems need to be a stand-alone, major chapter in the strategy, with a commitment to remote sensing, modeling, GIS, and data base management. Whereas there is some discussion of these methods, not all are on the table, and there is no clear commitment to systematically fold these into a coordinated air quality capability to underpin the NAAQS.

The opportunity to participate is appreciated. If questions arise, please do not hesitate to let me know.

With regards,

George E. Taylor, Jr.
Professor
Associate Dean

Enclosure
G. Taylor review comments (08 July 2003)

cc: P. Hopke

National Ambient Air Monitoring Strategy (NAAMS) Review

George Taylor
George Mason University

08 July 2003

This document/initiative reflects a major commitment on the part of the Agency and demonstrates an encouraging move to long-term planning and the infusion of new methodologies. The Agency is complemented for this initiative.

As with any initiative, there are shortcomings in spite of the fact that the effort demanded a huge investment of intellectual capital. Many are offered from the vantage point of the discipline of ecology and natural resources. Some of these shortcomings are of minor importance but others strike at some of the core of the proposed initiative. Given the breadth and nature of the concerns, I am concerned that the proposed initiative is not fully capable of developing and implementing a strategy that is forward looking, particularly with regard to ecology, natural resources and the linkage between human health and human well being.

Each of the concerns is explored in more depth below.

1. Breadth and Depth. The total set of materials in support of this strategy exceeds 600 pages. I would propose that the document be re-crafted in less than 50 pages as a strategy *per se*; anything above that page number and the argument is incrementally lost not only to the Agency but the intended audience. The verbiage suggests a problem in focusing on the most important issues and crafting the argument to be targeted.

One option is to have an appendix of detailed information (read by very few and is the existing document) and a far more concise, focused and viable "Strategy". The sheer size of the document does a disservice to the initiative's creativity and responsiveness.

2. Lack of Focus: What are the Missing Receptors of Concern? There are three reasons for the existence of air quality standards and they are the following:

A Protect human health and well being
A Protect natural resources that have a resource economic value that supports human well being (e.g., agroecosystems, managed forests, recreation)
A Protect the intrinsic value of ecosystems irrespective of the service flows to humans as these ecosystems may directly and indirectly affect sustainability and quality of life in ways we do not fully understand an appreciate.

Two of the three receptors are ignored in this strategy (Items No. 2 and 3). It is unclear if the initiative is cognizant of the mandate that the Agency has to address these issues. In the absence of these focus, it is premature to proceed with any initiative as to exclude these two is inappropriate and inconsistent with the legal mandate of the Agency.

3. Information Technology. The document surfaces the value of infusing information technology as one of the cornerstones of the new initiative. The focus is on data loggers, telemetry, linkage to risk communication, graphics, etc. While these are all part of information technology, they are mainstays of the information technology of nearly generation ago, which in the field of computational sciences has a lifetime of 3-5 years.

I would encourage the Agency to step onto the new generation of information technology, which is focused on a whole new cadre of tools, methodologies and capabilities. These new skills include new approaches to data management, data fusion, interoperability of data sets and standards, on-the-fly analyses, linkage to GIS in real time, etc. It is recommended that the Agency acquire this new generation of capabilities now, as it is the state-of-the-art.

4. Monitoring versus Scaling. The Agency is wetted to the concept that its primary responsibility is monitoring. This is a critical part of the initiative. However, in conducting a simple risk assessment, it is clear that one of the largest areas of uncertainty is scaling site-specific measurements to broader spatial and temporal scales. This is recognized in the initiative but quickly loses ground as a priority.

I would encourage the Agency to re-visit its commitment to scaling as many of the major shortcomings in the existing risk assessment programs reflect far too few resources devoted to placing this on the front burner. It becomes even more important as the number of sites is scaled back. The obvious technologies to address his shortcoming are GIS, computational modeling and remote sensing.

5. New Technologies for Monitoring. The initiative re-invests in site-specific monitors based on existing technologies but modified as the science improves multiple features. This is appropriate.

However, there are other technologies that could significantly enhance the monitoring, most notably in the area of remote sensing. This technology has multiple advantages over site-specific monitors and could easily address some of the recognized shortcomings.

In addition, the revolution in remote sensing is progressing with a 3-5 year generation time so new advances are coming on-board annually. For example, hyperspectral imagery (HSI) is emerging now as a powerful tool for the environmental sciences in multiple media (atmosphere, biosphere, geosphere and hydrosphere), and it has an impressive background in the intelligence community.

It is important to get these new technologies as part of the initiative now otherwise the door may close as folks become fixated on what can and can not be accommodated as the best-available science. Notable examples that far surpass site-specific monitors address PM, visibility, trace elements and ozone, but other pollutants are being investigated actively. Remote sensing can easily help in the distribution problem of monitors in non-populated areas, but I would argue it has a role in monitoring *per se*.

I would recommend that the information technology side of the initiative be re-reviewed before proceeding.

6. Rural Environments. As in the past, the focus of the initiative continues to be on the urban landscapes with few if any suggestions that rural landscapes are important. There is some mention of background concentrations, transport corridors, etc.

While the human health perspective is appropriate, rural landscapes need to be a commitment in this new generation. The Agency has recognized this shortcoming for a decade now but this recognition fails to have a place at the table.

7. Modeling Complement. The discussion regarding modeling techniques that assist in the analysis is a welcomed addition. The only concern is that the modeling role is tertiary. I would elevate it to a secondary priority right now and within a decade it may vary well replace monitoring as the chief tool.

There are a host of new discoveries in everything from knowledge mining to machine learning to on-the-fly modeling (linked with GIS and remote sensing) that is changing the role that these technologies have in what was previously viewed as "hard sciences". I would recommend an investment now in the methodology as it solves in part the Agency's budget problems and facilitates the risk communication thrust and scaling issue.

Moreover, if you are not aware of the emergences of the capabilities and have a place for them at the table, the Agency is likely to be devoured by them.

8. Linkage to Exposure. The issue of concentration in the atmosphere to exposure is not well addressed. There is some mention in ecology on doing some deposition analyses (e.g., CASTNET), but the remainder of the exposure issue is largely ignored. This is particularly important for HAP's as a means of prioritizing resources. Biosensors are likely to be the most significant area of enhancing the analysis.

Exposure has never been easily addressed in the past but the technology has changed in the last 3-5 years, particularly in ecology and natural resources. For example, ecotoxicogenomics has emerged as a means of understanding the linkage between changes in ozone in the atmosphere and the responsiveness of at-risk species in the forest canopy. Other new capabilities exist in the application of modeling tools to establish a linkage between concentration over time and exposure.

Is it possible to bring in exposure estimates (monitored or modeled) for human health and ecology?

9. Locations for Monitors to Address Ecology and Natural Resource Issues. I would encourage some discussion of how monitoring and scaling might be done in ecology and the environment. For example, one way would be to locate monitors at LTER sites in North America. This would be recognition on the part of the Agency that ecology and natural resources are important and a legal mandate.

10. GIS Tools. The application of GIS tools is discussed. The only shortcoming is that GIS tools should be playing a far more significant role in both the monitoring, modeling, and risk communication.

From my ecological and modeling vantage point, it appears that the initiative underestimates the value of GIS.

11. Quality Assurance and Quality Control. Far be it for an ecologist to question the QA/QC of monitors, but I would argue that the efficacy of the QA/QC process is less than is recognized and this might warrant attention in any new generation of monitoring. Most assume that QA/QC is so routine that it is failsafe, but I would argue that there is plenty of room for improvement (understatement).

This is where remote sensing could provide a very valuable role as it provides an independent tool to co-monitoring of concentrations.

12. Air Toxics. The argument is made from a risk assessment that air toxics are emerging as a far greater risk to human health, human well being, and ecology.

I would encourage the Agency to make sure that this assessment is accurate and reflects the science. In particular, I would encourage that the air toxics' initiative be focused on those few toxics that really pose a risk. Otherwise the potential exists to invest in an expensive monitoring program with very limited risk associated with the pollutants.

13. Risk Communication. I applaud the commitment to risk communication to multiple audiences. I would encourage the Agency to be far bolder in its commitment to this part of the effort as it is very important in getting the public involved. My perspective is that the value of risk communication is underestimated and the IT initiative can help make this component effective.

14. Who Is Handling the More High Technology Initiatives? The effort places a priority on bringing into the fold modeling, information technology, risk communication, GIS, etc.

These capabilities require resources that are not really available to EPA, states or tribes. These skills are likely to be shared, with some being nationally responsive but others operating at a local level. It is unclear how this resource constraint is addressed. One notable example is the ability to model atmospheric dispersion, chemistry and deposition at a local scale. It is hard to identify folks to do that for high priority issues (e.g., bioterrorism in urban canyons), so it is unlikely that such skill sets exist for multiple local applications each with its unique meteorology, surface topography, source terms and at-risk landscapes and receptors.

15. Reactive Nitrogen in the Atmosphere. Nitrification of continental landscapes (aquatic and upland ecosystems) is emerging as one of the top three issues in ecology and natural resources. While there is a reason for ecological concern *per se* (e.g., eutrophication of surface waters, nitrification of forested landscapes, etc.), there is a significant reason for concern for human health (e.g., *Pfiesteria*) and human welfare (e.g., recreation, fisheries, invasive species).

I encourage the Agency to maintain a high profile commitment to nitrogen, particularly reactive nitrogen species (e.g., HNO3).

16. Linkage to NASA, NOAA and NPS. While there is some mention of linkages, there is little clear understanding of what will actually be pursue.

It is critical to the success of this program that remote sensing and data management expertise in NASA and NOAA be brought to the table. The program's success depends on that. NPS is

important to strengthen the commitment to ecology, which is poorly articulated and remains a problem in the priorities of the Agency.

17. Missing Pollutants. There are some pollutants that are not mentioned but for which their inclusion might warranted some discussion. Examples are UV-B, stratospheric ozone, CFC's and CO_2. The last is offered seriously as the cost is minimal with new technologies, CO_2 is a surrogate for other species, and the public is largely uninformed about the variability in CO_2 spatially and temporally. This would be of value in modeling but would be of value in risk communication. The value of including UV-B is that the Agency has one an excellent job in developing the principle of risk communication (most local stations now include this communication) and the public responds well to this initiative.

Dr. Warren White

Initial comments on NAAMS   Warren White, 7/6/03

The initiative summarized in the September draft of the NAAMS is a wonderful model of how the Agency should carry out its responsibility for Environmental Protection. It grew out of a problem rather than a legislative directive, proceeded by sustained consultation with a diverse community of experts and affected parties, and supported these deliberations by commissioning exploratory analyses of existing information. If effectively implemented, it should greatly strengthen the information base for future decisions, on both the formulation of standards and strategies for achieving them. Both the initiative, as a way of doing business, and its product, as a set of recommendations, deserve high praise and earnest consideration.

I would use somewhat stronger language to answer the question "What's wrong with the existing air monitoring network structure?" (Summary, page 9). Recognizing that the authors are better attuned than I to the disposition of their intended audience, and therefore deferring to their judgment, here is how I would have stressed the qualitative shift in paradigm.

- The first thing wrong is that past monitoring for public health was overly focused, especially before the advent of the PAMS and Speciation Networks, on pollutant species that had been formally determined to impair health at or near existing ambient levels. But there are excellent reasons for wanting systematic data on some of the low-toxicity species as well, particularly the directly emitted precursors of more toxic species, and co-emitted tags for specific types of emissions.
- The precursors are what emissions controls directly affect, and are thus the natural tracking variables for "accountability" purposes. Their atmospheric transport and processing are what determine the incidence of health effects in time and space. These primary species would be the prime candidates for "nudging" of predictive models for ozone and PM as envisioned on Summary page 10.
- Evidence of health effects at existing levels typically comes from epidemiological analyses, and there is a chicken-and-egg problem if only species of demonstrated toxicity can be widely monitored. Source tags carry valuable information on the mix of emissions and, by inference, on co-emitted species that may difficult to monitor directly.
- The second thing wrong with the existing network is the great scarcity of multi-pollutant sites. This point could be driven home by counting up the total number of sites with collocated measurements of PM, O_3, SO_2, and CO. This number must be minuscule, and yet these four criteria pollutants yield much more information together than they do in isolation.
- All four pollutants are implicated at various locations and times by existing epidemiological analyses, whether as causal or confounding variables. Analyses that cannot account for all four simultaneously are limited in their ability to associate health effects more specifically than with "dirty air", as discussed on Summary page 13.
- SO_2 and CO are so rarely measured together because their "hot spots" are typically in different settings, and their NAAQS are threatened only there. But SO_2 and CO remain relevant at much lower concentrations as source tags and, in the case of SO_2, as a PM precursor. Unfortunately, as Summary page 10 notes, old NAAQS-oriented monitors typically lack the

resolution necessary to yield useful data at lower concentrations, even where they are employed.

Two minor caveats:

Summary page 9 refers to “hazardous air pollutants (HAPs) which project to be more important air quality concerns than all current criteria pollutants”. That certainly gets the reader’s attention … but is it supportable?

Summary page 22 gives the only disclaimer I see that the data needs of model evaluation are “beyond the scope for NCore.” I think that merits more emphasis so that NCore doesn’t get the same knock as the Supersites, which are sometimes claimed (unjustifiably) to have failed at their (erroneously) assumed role of providing such model evaluation data sets.

Additional comments, after meeting 7/9/03

I would stress the value of “Phasing network deployment ... to minimize startup problems” (Summary page 33), particularly given the desire to move toward a “performance-based measurement process.” As Dr. Demerjian noted, data quality objectives for a measurement system such as “the” particle speciation monitor are multifaceted and complex. Some of the myriad performance characteristics relevant to these objectives almost certainly will become apparent only during the course of actual deployment and initial use.

In a related vein, I suggest an explicit commitment to the overlapping of old methods with their proposed replacements, in routine field operation, before any existing measurements are discontinued. This is already implicit in the spatial analysis of level 3 measurements, where the sites to be discontinued are first established to be redundant by such comparisons with their neighbors. For the introduction of new technology, overlap would be achieved by temporarily collocating the new and old monitors at the same site. Such collocation, over substantial periods of time at a representative sample of sites, would help to reassure those concerned about issues of historical continuity, which can be critical for assessing health effects and the effectiveness of emissions regulations. The commitment might be expressed as an additional bullet under “key operating principles”, on Summary pages 7 and 8.

The Strategy’s recurrent themes of periodic reassessment and open-ended iteration are critical to its success. And an essential ingredient of a timely reassessment is timely data access, as panel members repeatedly stressed during our meeting – this is a priority that deserves more attention from the Agency.

A simple illustration of the need for periodic and iterative reassessment is provided by the goal of discontinuing some PM2.5 FRM sites and converting others to continuous operation, as sites that appear equivalent in terms of 24h averages could turn out to have dissimilar diurnal cycles.

Finally, I wouldn’t want to close without reaffirming my praise for essentially all the recommendations in this strategy, the manner in which they were pulled together, and this welcome exhibition of Agency initiative.

Appendix B – Roster and Biosketches of the CASAC NAAMS Subcommittee

U.S. Environmental Protection Agency (EPA)
Science Advisory Board (SAB) Staff Office
Clean Air Scientific Advisory Committee (CASAC)
National Ambient Air Monitoring Strategy (NAAMS) Subcommittee Roster*

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Also Member: Research Strategies Advisory Committee
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Dr. Rudolf Husar, Professor, Mechanical Engineering, Engineering and Applied Science, Washington University, St. Louis, MO

Dr. Armistead (Ted) Russell, Georgia Power Distinguished Professor of Environmental Engineering, Environmental Engineering Group, School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, GA

Dr. Roger L. Tanner, Principal Scientist, Air, Land and Water Sciences Department, Environmental Research & Technology Assessments, Tennessee Valley Authority (TVA), Muscle Shoals, AL

Dr. Warren H. White, Visiting Professor, Crocker Nuclear Laboratory, University of California - Davis, Davis, CA

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* Members of this SAB Panel consist of:

a. SAB Members: Experts appointed by the Administrator to serve on one of the SAB Standing Committees; and

b. SAB Consultants: Experts appointed by the SAB Staff Director to a one-year term to serve on ad hoc Panels formed to address a particular issue.

Biosketches of CASAC NAAMS Subcommittee Members

CASAC MEMBERS

Dr. Philip K. Hopke

Dr. Philip K. Hopke is Bayard D. Clarkson Distinguished Professor, Departments of Chemical Engineering and Chemistry, Clarkson University.

Dr. Hopke's areas of expertise, research activities, and interests are: multivariate statistical methods for data analysis; sampling and analysis of airborne particulate matter; characterization of source/receptor relationships for ambient air pollutants; experimental studies of homogeneous, heterogeneous, and ion-induced nucleation; indoor air quality; and exposure and risk assessment.

Dr. Hopke's Ph.D. (1969) and M.A. (1967) are from Princeton University in Chemistry. His B.S. in Chemistry was from Trinity College, Hartford, CT.

Currently Dr. Hopke is Vice President of the American Association for Aerosol Research and Associate Editor for Reference Data Sets, Chemometrics and Intelligent Laboratory Systems. He was formerly Editor-in-Chief of *Aerosol Science & Technology* from 1993 through 2002.

Dr. Hopke has served as a member of the Executive Committee of the EPA Science Advisory Board from 2000 until 2004 and also chairman of the SAB's Clean Air Science Advisory Committee (CASAC) for the same time period. Currently he is also a member of the SAB's Research Strategies Advisory Committee. He participates as a member of the NAS/NRC Committee on Air Quality Management and their Committee on Research Priorities for Airborne Particulate Matter.

Dr. Hopke recent and current grant and other contract support includes consulting on scientific and technical matters related to: particulate matter, particle monitoring, semi-volatile pollutants, vapor nucleation, EPA Supersites, sources of PCBs, regional air quality monitoring, and computational fluid dynamic modeling in humans for the Federal government (EPA & NIOSH), a state agency (NYSERDA), and the National Science Foundation (NSF).

Mr. Richard L. Poirot

Mr. Richard L. Poirot is an Air Quality Planner with the Vermont Dept. of Environmental Conservation. His field of expertise includes air quality data analysis (especially for ozone & precursors, PM-2.5 and regional haze), receptor modeling, source attribution, and aerosol/visibility effects.

Mr. Poirot is current chair and member of the Mid-Atlantic North East Visibility Union (MANE-VU) Regional Planning Organization (RPO) Ambient Monitoring and Data Analysis Workgroup and also current co-chair and member of the Inter-RPO Monitoring and Data Analysis

Workgroup. He is United States co-chair and member of the New England Governors'/Eastern Canadian Premiers' Acid Deposition Workgroup on Trans-boundary Data Exchange. He is former chair and a member of the Northeast States for Coordinated Air Use Management (NESCAUM) Ambient Monitoring and Assessment Committee.

Mr. Poirot received a B.A. (Geography and Environmental Studies Program) from Dartmouth College in 1972.

Mr. Poirot is a former member of EPA's: (1) Acid Rain Advisory Committee; (2) FACA Subcommittee on Ozone, Particulate Matter and Regional Haze of the Science and Technical Support Workgroup; and (3) Ozone Transport Assessment Group (OTAG) Monitoring and Data Analysis Workgroup. He has further served as a member of several committees, including: National Atmospheric Deposition Program (NADP) Technical Committee; Interagency Monitoring of Protected Visual Environments (IMPROVE) Steering Committee; Visibility Information Exchange Web System (VIEWS) Steering Committee; US-Canada Air Quality Agreement Subcommittee on Scientific Cooperation; and US-Canada Air Quality Agreement, Workgroup on Trans-boundary PM2.5 Modeling and Data Analysis.

Dr. George E. Taylor

Dr. George E. Taylor is Professor and Assistant Dean, School of Computational Sciences, George Mason University, Fairfax, VA. His areas of expertise and research encompass the environmental sciences and plant physiological ecology, including ecological risk assessment, atmosphere-biosphere exchange of trace gases, remote sensing of terrestrial landscapes, plant stress physiology, and ecological modeling.

Dr. Taylor is presently a CASAC member, and a member of the Environmental Technical Implementation Panel, American Chemistry Council. His editorial activities include**:** Editor, *Environmental Toxicology and Chemistry***;** Associate Editor, *Journal of Environmental Quality*; and Editorial Board, *Tree Physiology***.** He has more than 100 publications in peer-reviewed open literature.

Dr. Taylor's Ph.D. is in Biology from Emory University (1976), and he was a Postdoctoral Fellow in Physiological Ecology (1977-1979). His B.S. is in Biology from Randolph-Macon College (1971).

Dr. Taylor's sources of recent grant and/or other contract support funding include: (1) Virginia Access, NASA grant (M. Kafatos, senior PI), remote sensing for environmental applications (current); (2) Inventory of Chesapeake Bay Wetlands, EPA (S. Prince, senior PI), remote sensing of wetlands in the Chesapeake Watershed (current); (3) Natural Resource Inventory of Meadowood Farms, BLM (G. Taylor, senior PI) (current), remote sensing and GIS data base for resource analysis; (4) Chesapeake Watershed Cooperative Ecosystem Study Unit, NPS, BLM, USGS and DoD (L. Pitelka, senior PI) (current), large-scale cooperative agreement among multiple universities and government agencies; and (5) modeling the dose of atmospheric pollutants to terrestrial plant communities, NPS (G. Taylor, senior PI) (pending), developing linked models at multiple scales to characterize gas-phase pollutant (ozone, N and S) exposure and dose in plant canopies in the National Capitol region.

CONSULTANTS

Dr. Praveen K. Amar

Dr. Praveen K. Amar is the Director of Science and Policy for the Northeast States for Coordinated Air Use Management (NESCAUM), Boston, MA. His areas of expertise, research activities and interests include: (1) implications of scientific findings for air pollution policy on state, regional, and national scales; and (2) atmospheric modeling of ozone and fine particles on regional scale. Dr. Amar was the conference chair or co-chair of the annual symposium at Endicott House, Boston, sponsored by MIT and Caltech. He also represented States' stakeholders at the EPA's NSR Advisory Subcommittee (1993-1996). In addition, he currently represents stakeholders from States in the national FACA process on developing MACT for mercury from coal-fired boilers.

Dr. Amar earned his M.S. (mechanical engineering) from California State University, Los Angeles in 1971; and his Ph.D. in engineering from UCLA in 1977. He was a member of the Science Advisory Committee, MIT/Caltech Center on airborne organics (1993-2001); and was a member of the NARSTO synthesis team on ozone assessment (1996-2000). In addition, Dr. Amar is a member of the Science Advisory Committee, NYSERDA's EMEP program, State of New York (1999-present); and is contributory author to the NARSTO PM assessment (2000-2003).

NESCAUM receives its funding from EPA (section 103 and 105 grants), its member States, and foundations. Dr. Amar's recent funding within NESCAUM has come from EPA (CAMD and OAR) on the subjects of monetizing benefits of controlling mercury from coal-fired units, and cost-effective strategies for reducing emissions from distributed generators such as diesel engines. A forthcoming (Summer 2003) EPA STAR grant project with Georgia Tech and MIT will evaluate the effect of global climate change on regional air quality for ozone and fine particles.

Mr. Craig Beskid

Mr. Craig Beskid is the Executive Director of the Mickey Leland National Urban Air Toxics Research Center. His areas of expertise include ambient air monitoring of criteria and air toxics, and the health effects of urban air toxics. He was awarded an M.S. in Engineering from the University of Florida, 1980.

Mr. Beskid is the author of a professional article recently published in *Environmental Health Perspectives* (August 2002), entitled, "Environment Air Toxics: Role in Asthma Occurrence?"

His service on other advisory committees and professional associations includes: Chairman, Regional Air Quality Planning Committee (RAQPC), organize and lead meetings of government, academia and industry on air quality and environmental health issues; Vice-Chair, Greater Houston Partnership (GHP), organize and lead meetings of government, academia and industry on air quality and environmental health issues; and Board President, Houston Regional Monitoring (HRM), oversee fiscal and technical management of 7 site air quality monitoring program.

The Mickey Leland National Urban Air Toxics Research Center receives EPA Assistance grants.

Mr. Bart Croes

Mr. Bart Croes is currently Chief, Research Division, California Air Resources Board and director of the State's health and exposure research program. An atmospheric scientist with a background in air quality simulation modeling and a P. E. in Chemical Engineering (California), Mr. Croes was formerly responsible for the design of California's air-quality measurement program.

Mr. Croes holds advanced degrees with an M.S. (Chemical Engineering) from the University of California at Santa Barbara, 1983, and a B.S. (Chemical Engineering) from California Institute of Technology, 1979.

Mr. Croes is Public Sector Co-Chair, Executive Assembly, NARSTO, and is a member of the National Research Council Committee on Research Priorities for Airborne Particulate Matter. He received the Editors' Citation for Excellence in Refereeing, *Journal of Geophysical Research*.

Mr. Croes has had the following articles published by the NRC: "Research Priorities for Airborne Particulate Matter: III" (2001); "Early Research Progress and Research Priorities for Airborne Particulate Matter: II" (1999); "Evaluating Research Progress and Updating the Portfolio" (1999); and, with M. S. Bergin, A. G. Russell, W. P. L. Carter, and J. H. Seinfeld, "Ozone Control and VOC Reactivity" (1998). He has contributed to numerous publications: *Encyclopedia of Environmental Analysis and Remediation*, John Wiley & Sons, Inc. (1995); "Acidic Deposition in California: Findings from a Program of Monitoring and Effects Research, Water, Air and Soil Pollution," 85; *Acid Reign '95, Proceedings from the 5th International Conference on Acidic Deposition*, June 26-30; and, with A. Russell, J. Milford, M. S. Bergin, S. McBride, L. McNair, Y. Yang, and W. R. Stockwell, "Urban Ozone Control and Atmospheric Reactivity of Organic Gases," *Science*, 269 (1995).

Dr. Kenneth Demerjian

Dr. Kenneth Demerjian is currently a Professor in the Department of Earth and Atmospheric Science, and Director, Atmospheric Sciences Research Center, and the University at Albany, SUNY.

His areas of expertise, and research activities and interests include: chemical kinetics and mechanistic pathways of elementary atmospheric reactions in polluted and clean atmospheres; instrumentation development and measurement of atmospheric trace gases and particulate matter; development and evaluation of air quality forecast models and diagnostic analysis of atmospheric processes within air quality modeling systems; and sources and evaluation of uncertainty in theoretical models of atmospheric processes, air quality, and pollutant exposure;

Dr. Demerjian's leadership positions in national associations or professional publications include: Associate Editor, *Atmospheric Environment*, November, 2002 to present; Board on Oceans and Atmosphere NASULGC, November 2001 to November 2004; Member, UCAR Members' Nominating Committee, October 2001 to present; and Chairman, Committee for the Atmospheric Chemistry and Environmental Education in Global Change, 1994 to 1999.

Dr. Demerjian was awarded his M.S. and Ph.D. in physical chemistry from the Ohio State University in 1970 and 1973, respectively. He received his B.A. in chemistry from Northeastern University in 1968.

Dr. Demerjian's service on other advisory committees and professional associations includes: Member, Research Committee, Health Effects Institute, July 2002 to present; Member, National Research Council Committee on Atmospheric Chemistry, August 1999 to 2001; Co-Chair, Synthesis Team - NARSTO, October 1996 to March 2000; and Member, National Research Council Committee on Research Opportunities and Priorities for the Environmental Protection Agency (ROPE), November 1995 to June 1997.

Dr. Demerjian's sources of recent grant and/or other contract support funding include: U.S. EPA, PM Supersite Cooperative Agreement, "PM2.5 Technology Assessment and Characterization Study - New York" (PMTACS-NY), January 15, 2000 - December 2004; New York Energy Research and Development Authority (NYSERDA), Contract, "Joint Enhanced Ozone and PM Precursors and PMTACS-NY Measurement Program," January 1999 - June 30, 2003; and New York State Department of Environmental Conservation, Environmental Bond Act Funds in support of PMTACS-NY, August 1, 1999 - July 2004.

Dr. David Diaz-Sanchez

Dr. David Diaz-Sanchez is Assistant Professor in the Department of Medicine, University of California, Los Angeles. For 15 years, Dr. Diaz-Sanchez' work has focused on the role of the environment in affecting immune responses with special emphasis on the ability of environmental agents to modulate the allergic and asthmatic response. For his Ph.D., he studied why workers in castor bean factories had very high incidence of allergy and asthma. Since that time his primary focus has centered on the link between industrialization and allergic diseases. Using human and animal models, Dr. Diaz-Sanchez has demonstrated and published extensively on the ability of combustion products to exacerbate allergy/asthma using the model pollutant diesel exhaust particles (DEP). In addition, his research has shown that particulate pollutants can also initiate allergy/asthma by promoting allergic sensitization.

Dr. Diaz-Sanchez received his Ph.D. from Guy's Hospital, London, England, in 1991, and B.Sc. from University College, London, England, in 1987.

Dr. Diaz-Sanchez served previously as a consultant to EPA’s Clean Air Scientific Advisory Committee (CASAC) from 1998 to 2001. In 1999, he worked at the Southern California Environmental Health Sciences Center and in 1998 at the Children’s Environmental Health Center in Southern California. He has recently served on the editorial boards of two publications; namely, *Clinical Immunology* in 2001 and *Immunology* in 2000.

Ongoing projects Dr. Diaz-Sanchez is associated with are: (1) NIEHS/EPA P01 ES09581, Respiratory Disease and Prevention 11/01/98 – 10/31/03 Project: “Modulation of Allergic Responses by Environmental Tobacco Smoke;” (2) NIH/NIAID P01 AI50495-01 Xenobiotics and Allergic Inflammation 09/01/01 – 08/31/06 Project: “Metabolic Pathways and Genes on Xenobiotic-Enhanced Allergic Inflammation”; (3) Allergy Research Foundation, Nasal Challenge with SCH 34117 02/01/00 – 01/31/03; and (4) Health Effects Institute Exacerbation of Allergic Inflammation in the Lower Respiratory Tract, proposed 05/01/03-04/30/06.

Dr. Rudolf B. Husar

Dr. Rudolf B. Husar is currently Professor of Mechanical Engineering, Director of Center for Air Pollution Impact and Trend Analysis (CAPITA), Washington University, St. Louis. In the early 1970s he was a post-doctoral fellow at the California Institute of Technology, Pasadena, CA.

His past research includes: atmospheric aerosols; regional and global air pollution transport and chemistry; biogeochemical cycles; environmental trend analysis; monitoring network evaluation and design. His interests include environmental informatics — the application of information science, engineering, and technology to environmental problems — as well as scientific support to air quality.

Dr. Husar has served as an executive editor of the journal *Atmospheric Environment*, and on the boards of five other international journals, including as Associate Editor, *Atmospheric Systems*; *The Scientific World*, (2001-present), member of Editorial Board, *Environmental Monitoring and Assessment*, (2000-present). He is a member of the Hungarian Academy of Sciences and served on five committees of the U.S. National Academy of Sciences. Dr. Husar has also served on numerous national and international panels and committees dealing with various aspects of atmospheric sciences and air quality management. He was a contributor to EPA’s Particulate Matter Criteria Document Panel in 1996.

Recent publications include articles (with others) in the *Journal of the Waste Management Association*, *Atmospheric Environment*, and the *Journal of Geophys. Res*. (all in 2001). Another article, "Sulfur and Nitrogen over North America, Global Aspects of the Environment," is available from the Elgar Reference Collection, Cheltenham, UK, and Northampton, USA (1999).

Dr. Husar's Ph.D. is in Mechanical Engineering from the University of Minnesota, Minneapolis, in 1966. He received a Dipl. Ing. in Mechanical Engineering from Technical University, Berlin, FRG.

Dr. Husar's sources of recent grant and/or other contract support funding include: National Science Foundation (NSF), Collaboration through Virtual Workgroups, 9/01/01-8/31/03; NSF, Digital Government: An Integrated Fire, Smoke and Air Quality Network, 6/01/02-5/31/06; EPA, A Web-based Visibility Information System, 5/98-5/03; EPA, Ozone and PM Air Quality Analysis in Support of Public Needs, 5/98-5/03; MARAMA-EPA, Source Apportionment of Air Quality Monitoring Data: Pair Aerosol/Trajectory Database Analysis Tool Development, 8/02-7/03; MCNC-EPA, Intercontinental Transport, 12/02-12/03; EPA, St. Louis-Midwest Particulate Matter (PM) Supersite, Monitoring Support, 1/00-12/03.

Dr. Armistead (Ted) G. Russell

Dr. Armistead (Ted) Russell is currently Professor at the Georgia Institute of Technology. His areas of expertise and research include air pollution engineering, air quality modeling, air quality policy analysis, particulate matter dynamics, and control strategy optimization.

Dr. Russell has chaired two National Research Council Committees (Evaluation of EPA's Mobile Model; CO Non-attainment in Topographically and Meteorological Problem Areas), and was a member of three others. He chaired the HEI Workshop on Diesel Source Identification and co-chaired the AAAR Annual Meeting. Dr. Russell has been a member of the EPA FACA subcommittee on Ozone, PM and Regional Haze. He received the Sigma Xi Sustained Research Award which concerned the NARSTO Ozone Assessment on Air Quality Modeling and NARSTO PM Assessment on a Conceptual Model for PM in the Southeast. Dr. Russell served on the Interagency Task Force on Oxygenated Fuels. He also is a finalist, Smithsonian Institute on Computing in the Environmental Sciences.

Dr. Russell received both his Ph.D. and his M.S. in Mechanical Engineering at the California Institute of Technology in 1985 and 1980, respectively. His B.S. was also in mechanical engineering from Washington State University in 1979.

Dr. Russell sources of recent grant and/or other contract support funding include: EPA (air pollution in the Southeast; PM dynamics, impact of climate change on air pollution control); State of Georgia (PM and ozone in Georgia); Southern Appalachians Mountains Initiative (atmospheric modeling of PM, ozone and acid deposition in the Southeast); Georgia Power (particulate matter monitoring in Atlanta; Emissions inventory development); Southern Company (particulate matter monitoring); Japan Clean Air Program (air pollution modeling); State of California (VOC Reactivity analysis); American Chemical Council (VOC Reactivity analysis); and Electric Power Research Institute (biogenic uncertainty).

Dr. Roger L. Tanner

Dr. Roger L. Tanner is currently the principal Scientist for the Air, Land and Water Sciences Department at TVA's Environmental Research Center in Muscle Shoals, Alabama. His professional affiliations include serving as a member of the American Chemical Society and its Environmental Chemistry Division; and as a member of the American Association for the Advancement of Science, the American Geophysical Union, and the American Association for Aerosol Research.

Dr. Tanner's professional interests include the analytical chemistry of trace substances in the atmosphere as applied broadly in the following interconnected areas: (1) formation of fine aerosols from gaseous precursors, their atmospheric equilibria, transport and transformation, and health effects; (2) atmospheric photochemistry, transformation and loss of inorganic and organic reactive nitrogen, sulfur and oxygenated compounds especially as related to atmospheric ozone levels; and (3) atmospheric and climatic effects of biogenic and biomass combustion aerosols.

Dr. Tanner has been involved in a large number of field measurement campaigns at numerous locations in the United States using both surface and airborne measurement techniques. He has also made measurements of airborne gases and particles at locations in Canada and Brazil, and published over 85 papers in peer-reviewed publications.

Dr. Tanner has served on the IUPAC Commission on Environmental Analytical Chemistry (1990-1995), the Electric Power Research Institute (EPRI) Advisory Committee on Health Effects Research, and EPA's Chemistry and Physics Review Panel (1986-1992, 1995). He has co-chaired several symposia on aerosol measurements, including most recently acting as co-chair for the American Chemical Society's Symposium on Environmental Chemistry of the Atmosphere: 2000 and Beyond in San Francisco, March, 2000. Dr. Tanner recently received an EPRI Environmental Sector 2002 Delivery and Applications Award as a Research Champion for aerosol measurements in the Great Smoky Mountains.

Dr. Tanner received his Ph.D. in Analytical Chemistry from the University of Illinois in 1969 under Professor Richard S. Juvet, and received his B.S. in Chemistry from Pennsylvania State University in 1964.

Dr. Tanner has received grants or contract support from the following entities: EPA, Cooperative Agreement through the Southern Oxidant Study; TVA, Data Analysis of SOS Data; and EPRI, Aircraft Data Analysis for CCOS.SESARM/VISTAS, Install and Operate Continuous Speciated Fine Particulate Monitors (Look Rock, TN), Application of CUF Plume Data to Assess Alternate Model Approaches. Internal funding was received from TVA for several projects related to ambient aerosol monitoring in the Tennessee Valley. For DOE and EPRI, Dr. Tanner participated in the Development of a Regional Site for Special Purpose Measurements of Fine Particulate Mass and Composition.

Dr. Warren H. White

Dr. Warren H. White is Visiting Professor, Crocker Nuclear Laboratory, University of California at Davis, and was formerly Sr. Research Associate at Washington University. He is a member of the American Mathematical Society (AMS) and the Air & Waste Management Association (A&WMA).

Dr. White's areas of expertise involve mathematics, atmospheric chemistry and optics, and aerosol science, with specific interests in trend analysis, attribution of effects to emissions, and the sensitivity of empirical models to measurement uncertainties. Dr. White has served the A&WMA on the Publications and Visibility Committees and as past Chair of the St. Louis Air Pollution Control Association. He has also served as Coordinator of the Symposium on Plumes and Visibility, Grand Canyon.

Dr. White holds both a Ph.D. and M.S. in mathematics from the University of Wisconsin, in 1964 and 1967, respectively. He received his B.S. from the California Institute of Technology in 1963.

Dr. White has worked with EPA on committees and panels, namely: Clean Air Science Advisory Committee (CASAC), 1996-2000; Review Panel for PM Criteria Document, 1994-96, 2000-03; Subcommittee on Particle Monitoring, 1998-2003, Review Panel for NOx Criteria Document, 1990-94; and Subcommittee on Visibility, 1987-89. He has served on the following committees of the National Research Council (NRC): Haze in National Parks and Wilderness Areas, 1990-93; Committee on Meteorological Prediction, Analysis, and Research, 1990-94; Committee to Assess the North American Research Strategy for Tropospheric Ozone (NARSTO) Program, 1997-2002; and Committee on Research Priorities for Airborne Particulate Matter, 1998-2003.

Dr. White has worked under a contract from National Park Service to Crocker Nuclear Laboratory to operate the IMPROVE monitoring network and also on a cooperative agreement between EPA and Washington University to operate St. Louis-Midwest PM Supersite. He has been a consultant to the Electric Power Research Institute (EPRI) on analysis of monitoring data from Atlanta, and to Environ Corp. on a test of source apportionment with simulated data.

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